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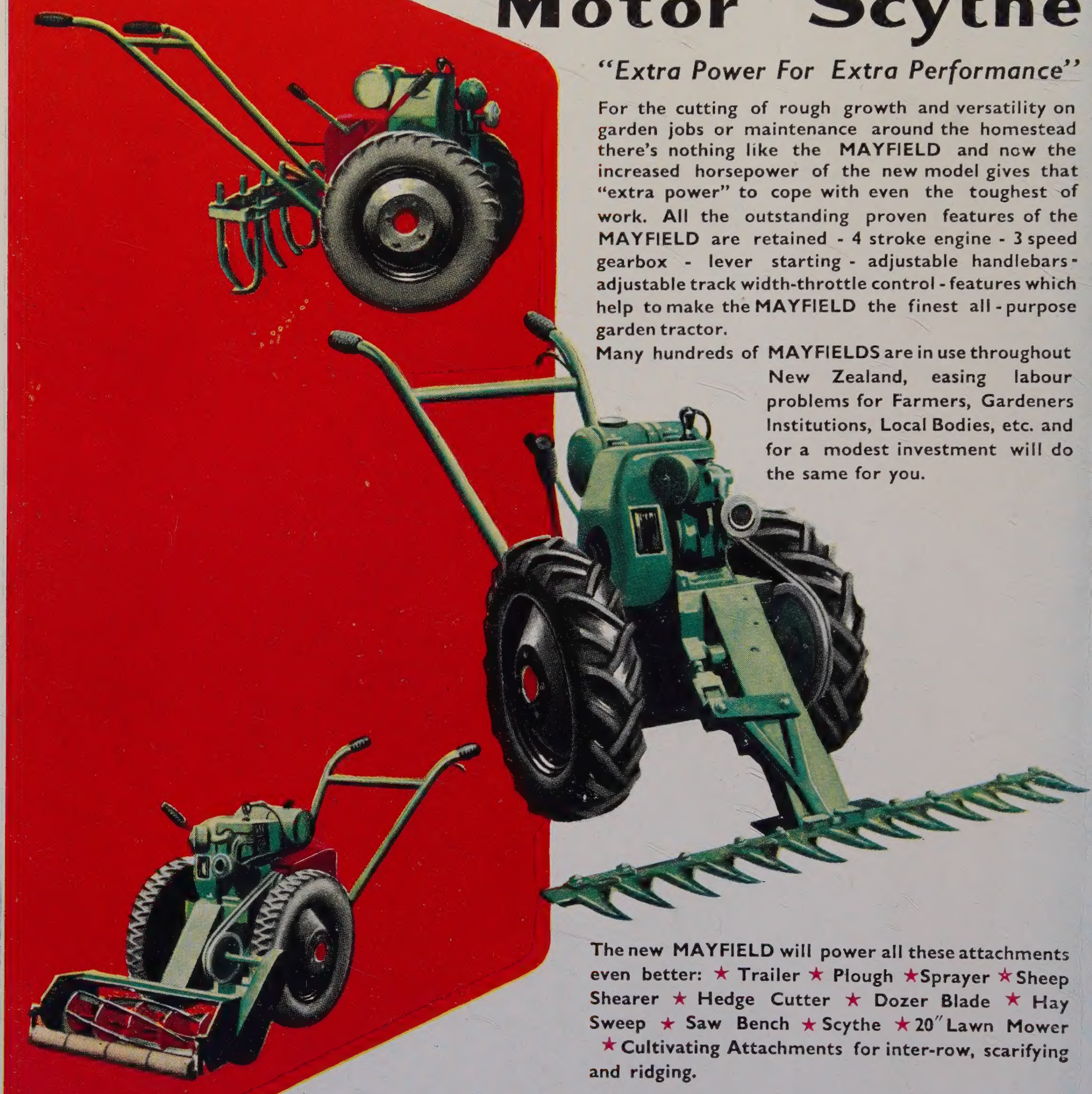

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Coronation Cover

NEW ZEALAND JOURNAL OF AGRICULTURE
MAY 1953

This month "The New Zealand Journal of Agriculture" carries its Coronation cover, which shows Her Majesty, when Princess Elizabeth, mounted on a charger during the Trooping the Colour ceremony in 1947 against a background of the Royal Crest. She wears the uniform of a colonel of the Grenadier Guards. The cover was reproduced from a Flexichrome (Kodak (N.Z.) Ltd.) print by Perry Photographer, in the preparation of which a statuette of Princess **Elizabeth** *and her charger was photographed. (See article on Royal farms on page 415.)*

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HEADING PHOTOGRAPH: A spring crop of Potentate nearing maturity in an unheated glasshouse. The plants were grown in single rows 3ft. apart and were spaced 12in. apart. The crop averaged 12lb. of fruit per plant.

Growing Tomatoes in Glasshouses

PRODUCTION of tomatoes under glass, which has become one of the most important features of commercial vegetable growing in New Zealand, is described by S. O. Gillard, Horticultural Instructor, Department of Agriculture, Auckland, in this article, the second part of which will appear in next month's "Journal". A survey of glasshouse production of tomatoes conducted by the Department of Agriculture in 1950 showed that there were then about 1000 commercial growers, who operate some 2200 glasshouses, representing a total area of about 5,100,000 sq. ft. About 2,100,000 plants, with an average yield of 4½lb. per plant, are grown annually. Most of these crops are grown to supply the markets from May to February.

COMPARATIVELY few tomato glasshouses in the Auckland and Nelson Provinces are heated. In Hastings the proportion is much greater, and the importance of artificial heating increases in districts farther south.

In the Auckland district it is the practice of some growers to plant two crops of tomatoes each year; one is planted in the last week of February for an autumn and winter crop and one in July or August for a spring crop. This practice allows an interval of only 3 to 4 weeks between the finish of the spring crop and the February planting of the next.

Methods of planting vary considerably. A number of growers plant on a level soil surface and ridge the soil up around the plants later. Others plant in wooden or concrete troughs (see "Tomato Culture in Troughs under Glass", the "Journal", November 1948), a method mainly practised when excess soil moisture from adjacent land cannot be controlled. A few grow the crop in large pots or kerosene tins cut in halves; but the most widely used method is to plant in shallow depressions or trenches as described in this article.

For the successful production of glasshouse tomatoes the important factors are climate, soil type, site, water supply, and shelter. The cost of establishing glasshouse units is so high that full consideration must be given to all of these factors if losses or disappointing results are to be avoided.

Climate

It has been found that intensity of light and the total hours of bright sunshine are major factors in successful tomato production, and consequently sunny districts provide the best conditions for a heavy crop. Using light to the best advantage is also a first consideration and it has been found that glasshouses built east and west produce earlier-maturing fruit than do houses with their ends facing in other directions.

So that plants set out in glasshouses running east and west may receive the maximum of light it is recommended that plant rows be established crosswise in the house, that is, north and south. This method of planting, with its shorter rows, allows more convenient working of the growing crop than if plant rows are established lengthwise in the glasshouse.

Soil Types

Tomatoes are grown on many types of soil, including free-working volcanic and alluvial types and clay loams. The ideal soil is deep and well drained but with reasonably good moisture-holding capacity.

Soil water: The height of the water-table is important. Excess moisture close to the soil surface will create unfavourable conditions likely to hinder normal root development and will stimulate growth of fungi which destroy root tissue. Low soil temperatures brought about by excessive soil moisture will inhibit growth and delay the establishment of seedlings.

Few growers are fortunate enough to have the best type of soil, but those who are most successful have learnt not only how to obtain the best from the available soil, but ways to improve it by cultural practices and so overcome initial disadvantages.

Site

Particular attention should be given to choosing the position for a new glasshouse, as this may influence production even more than does soil type. If possible, an almost level site should be chosen. It should be one that does not receive drainage water from neighbouring land and should be free of risk of infection by diseases carried in surface water.

It is an advantage if the land has a fall lengthwise of the house of 1in. to each 10ft., as this allows for the gutters under the eaves to be parallel with the surface of the ground. If the fall is more than 2in. in each 10ft., the glasshouse will be more expensive to erect, as levelling of the site will be necessary. The soil surface should be regular and free from hollows or ridges.

An area free from frosts is a decided advantage and will keep fuel costs low.

Water Supply

There should be a good water supply on the site, as during the season the crop requires a considerable amount of water—as much as 1 gallon of water per plant daily at some periods. Water is usually procured from mains through local bodies, and charges may vary according to district from 1s. 6d. to 2s. per 1000 gallons. A disadvantage of a town water supply service is that sometimes in drought periods, when the demand for water is heavy, the flow may be so reduced as to be insufficient to meet the requirements of commercial glasshouses.

Another source is a bore from which water is pumped up into a reservoir. This is satisfactory provided sufficient quantity can be obtained at a reasonable depth and the soluble salt content of the water is not excessive.

In some tomato growing areas the water supply is supplemented by large reservoirs filled by catchment rainwater from adjacent buildings. Whatever the source of water galvanised pipelines should service the glasshouses and should be large enough to allow for sufficient volume of water at all times. Large glasshouses usually have 1¼ to 2in. diameter piping fitted.

Shelter

A live shelter belt established against the prevailing wind is an advantage, provided it is not close enough to cause shading of the glasshouse or build-up of frosts. Sunlight is so essential to glasshouse work that shading for even an hour a day must be avoided if possible.

Types of Glasshouses

Although many types of glass structures are used for tomato growing, including houses with steel and wood frames, most of the houses in New Zealand have wood frames. The modern houses are simple and easy to operate and have very efficient ventilation systems. Rafters and studs are usually 24in. apart, allowing free passage of light, though closer rafter spacings are recommended in districts where heavy snowfalls may be expected. Many growers favour houses with side walls 6ft. high and sloping inward. These provide ample air space for the plants and comfortable working conditions.

Houses are usually 30 to 40ft. wide with varying lengths up to 200ft. They are based on reinforced-concrete sidewall posts. A full description of construction of these glasshouses was given in the article "Modern Tomato Glasshouses" in the January 1950 issue of the "Journal".

Support Wires

Plants are generally trained to produce nine trusses, seven below the support wire and two above. For this reason and to give head clearance the wires are set approximately 6ft. 6in. from the ground. The growing plants are supported by lengths of binder twine, around which they are trained. The twine is tied to the base of the plant at one end and at its other extremity to the overhead support wire.

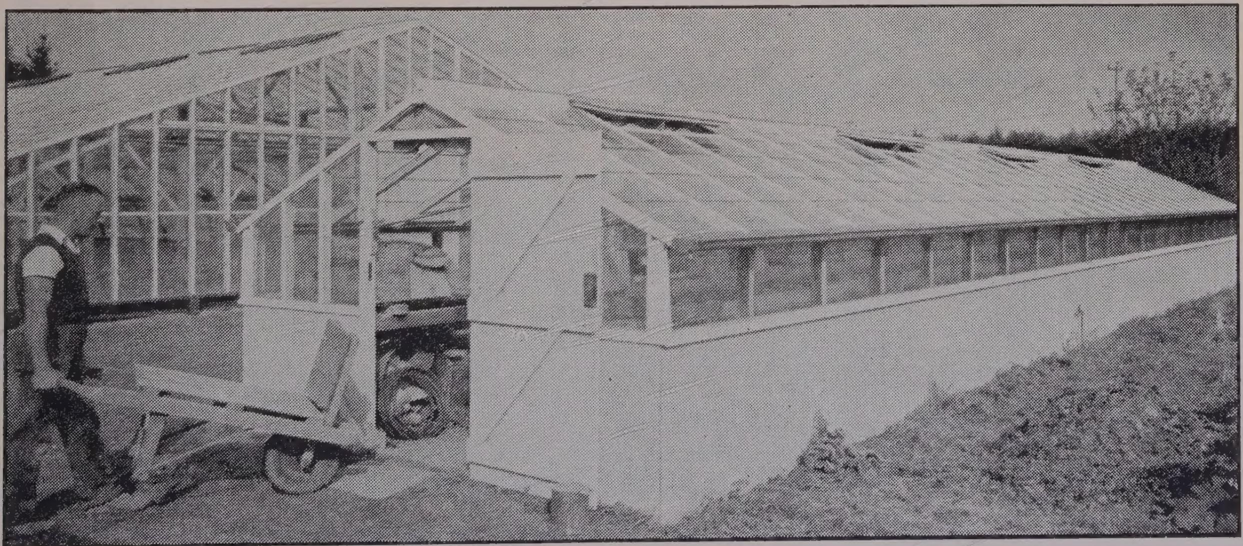
Support wires are usually No. 10 galvanised plain wire and are run the same way as the plant rows. The plant rows may be placed either across the house or lengthwise to suit the convenience of the grower. Plants in rows planted north and south will receive the maximum light and normally are best orientated in this way.

Plant and Row Spacings

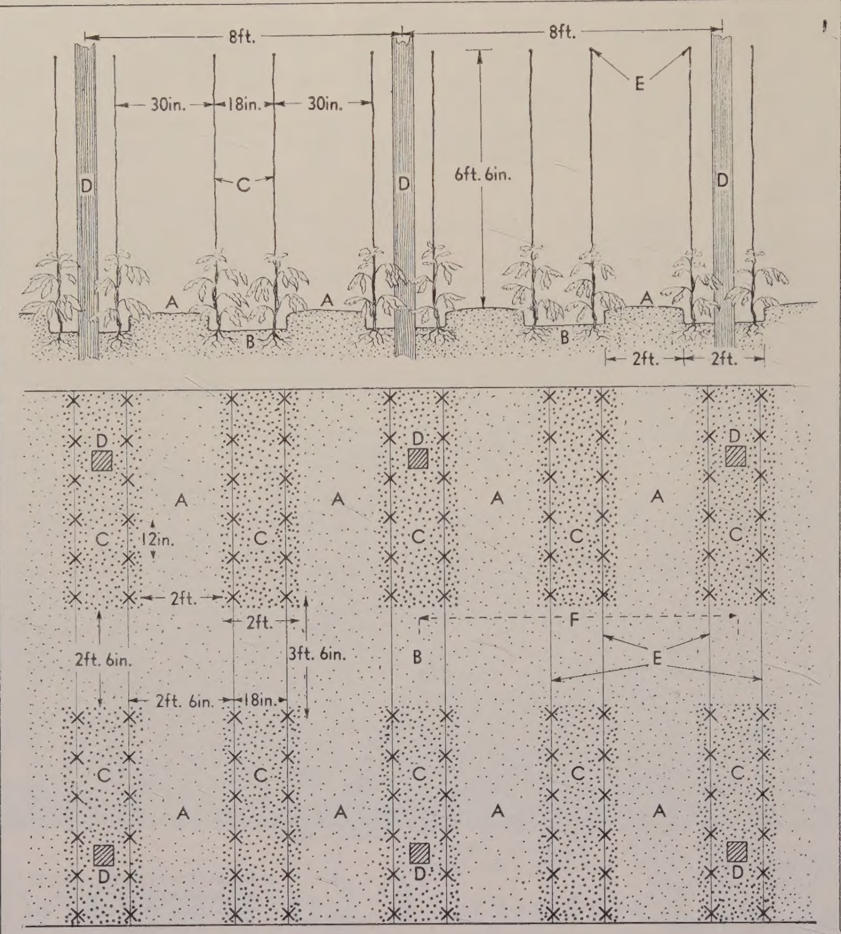
Opinions differ as to the best planting distances, but the most popular method is to set the plants in double rows 18in. apart with 30in. between double rows (see upper diagram on page 404). This system of planting gives the same average plant spacing as do single rows 24in. apart. The advantage gained is the convenience of the wider alternate rows for working.

The spacing of the plants and their supports has to be varied according to the spacing of the inner support posts so that the posts come between plant rows and are not in pathways, where they would be an obstruction during spraying, etc. This applies also to the floor markings for the plant beds and pathways when preparation for planting is undertaken. The following table sets out spacings for planting across the house (see also lower diagram on page 404):—

Distances apart of inner support posts ft.	
8	Support wires 18in. apart, 30in. between pairs of wires. Floor markings: 24in. plant bed and 24in. pathway.
8½	Support wires 21in. apart, 30in. between pairs of wires. Floor markings: 27in. plant bed and 24in. pathway.
9	Support wires 20in. apart, 34in. between pairs of wires. Floor markings: 26in. plant bed and 28in. pathway.



A propagating house large enough to accommodate 8000 plants. Ventilation is provided by sashes on each side of the roof. The rafters, spaced 24in. apart, allow plenty of light to enter. The wide doorway and pathway down the centre of the house are a convenient size for the plant trays to be taken in and out on a wheelbarrow.



Diagrams showing method of planting in double rows across the house. Upper: Position of plants in relation to support posts and support wires. A—Paths. B—Trenches 4in. deep. C—Twine. D—Posts. E—Support wires. Lower: Plan of layout. A—Paths. B—Central path. C—Double rows forming plant beds. D—Posts. E—Support wires 6ft. 6in. above ground. F—Complete bay.

Crop Rotations

Rotation of crops is seldom practised by New Zealand glasshouse tomato growers, but it is usual to grow a green crop of maize, barley, or broad beans for digging in to improve the humus content of the soil. A few tomato growers grow such crops as lettuce, cucumbers, or beans as an alternative crop.

Varieties

The selection of the most suitable varieties for any particular locality is not easy, as factors such as soil type, environment, and methods practised by the grower influence production. The most popular variety at present is Potentate, but Improved Bay State is also favoured.

Potentate

Potentate came into popularity in 1944 and during the last 8 years it has been grown extensively. It produces medium to large, round, firm, fleshy fruit and crops heavily, especially on the first five trusses. Root development is not particularly strong, but the variety grows fairly well in soils treated with steam or chemicals. The fruits mature quickly. It prefers warmer and damper conditions than average tomato varieties and reacts to early dressings of nitrogen such as dried blood. It also shows some resistance to tomato leaf mould.

Improved Bay State

Improved Bay State, a variety obtained from America in 1948 and planted commercially 2 years later, is being grown fairly extensively. It produces slightly above medium to large, round, firm, fleshy fruits and crops heavily, especially above the third truss. The fruit tends to be pale until fully ripe and ripens about a week earlier than Potentate. Root development is usually very vigorous. The variety prefers warmer conditions than even Potentate and is highly resistant to tomato leaf mould.

Other Varieties

Other varieties grown to a much less extent are Kondine Red and Best of All. These varieties, however, are gradually losing favour.

A good practice is to test new varieties. In assessing the merits of a new variety attention should be paid to weight of crop, size of fruit, colour, firmness, and flavour. These characters are important, as they have a bearing on the market price, which is governed to some extent by the preference of the consumer. There is great variation within varieties and it is important to obtain the best strains for commercial plantings.

Propagation

The cost of plants is a big item in production. Where propagation facilities and labour are available for the raising of plants for individual requirements it is strongly recommended that plants should be propagated by the grower, because the cost is less than that of buying plants, availability of plants can be regulated, and entry of disease organisms from outside sources can be minimised.

Where large numbers of plants are to be raised it is advisable to construct a special propagating house. These are usually 25ft. or more long, 11ft. wide, and 7ft. high with side walls 5ft. high. Walls are constructed mainly of asbestos sheeting or wood, with 24in. of glass under the eaves. Wooden benches to accommodate the plant trays are 30in. high and 3ft. 9in. wide and run the full length of both sides of the house, leaving a pathway 3ft. 6in. wide down the centre. Ventilation is provided by wooden sash ventilators 4ft. long by 1ft. 6in. wide spaced alternately on either side of the ridge and 8ft. apart on each side.

Propagation houses should be thoroughly cleaned and disinfected and all seedling boxes should be similarly treated.

Only a general recommendation can be made about soil for seed boxes, but certain principles must be observed. Too rich a soil is not advisable, but it should be sufficiently open in texture to induce rapid root growth and yet be sufficiently retentive of moisture to avoid rapid drying out. It should also be steam disinfected or treated with a reliable soil disinfectant.

Generally any average topsoil, preferably from a pasture or from a field that has not grown tomatoes, is satisfactory. To every 5 parts of soil 1 part of well-rotted stable manure or compost and a sprinkling of carbonate of lime should be added and the whole mixed thoroughly. The John Innes Horticultural Institution recommends the use of a standard compost made of 2 parts of medium loam, 1 part of good peat, and 1 part of coarse sand. To every cubic yard of compost 2lb. of superphosphate and 1lb. of carbonate of lime should be added. The loam should be disinfected before the compost is mixed.

Seed Saving

Only the best seed should be purchased, as the extra expense for good seed is a relatively small item. Many growers prefer to save their own seed by selecting the best fruits from carefully chosen, vigorous plants carrying heavy, disease-free crops. When suitable plants have been selected fruit from the first two trusses may be harvested and marketed. The remaining fruit should be left to ripen fully on the plants, when the final selection may be made.

Extraction of Seed

As several serious diseases are commonly carried with the seed of tomatoes, seed extraction should be by the following method, which will eliminate infection:—

Acid extraction: The fruit is weighed and the pulp then squeezed into a wooden container. Commercial hydrochloric acid (1 fl. oz. of acid for each 5lb. of fruit) is stirred into the pulp with a wooden stick. Occasional stirrings are given during the next 3 hours. The seed may then be placed in a fine sieve or muslin bag, washed under running water, and set out to dry in the sun. Acid extraction is fast and not only eliminates seed-borne diseases, but gives a bright seed sample with high germination.

Seed treatment with acidulated mercuric chloride: When seed of unknown origin is used it should be soaked for 5 minutes in acidulated mercuric chloride solution (1 gm. of mercuric chloride dissolved in 2.5 c.c. of concentrated hydrochloric acid added to 2000 c.c. of water). After treatment seed should be dipped in skimmed milk and dried thoroughly before being sown.

Seed Sowing

An ounce of seed should produce from 5000 to 6000 plants. Seed is sown in seed boxes which for convenience should be of a standard size (16½in. x 12in. inside measurement) and accommodate 35 plants (5 across and 7 lengthwise).

The prepared soil is passed through a ½in. sieve, the boxes are filled, and the soil is pressed down to within about ½in. of the top, any fibrous material caught in the sieve being placed in the bottoms of the boxes. The soil should be firmed evenly, particular attention being paid to the corners. If the soil is very dry, it should be watered before the seed is sown.

The number of seeds planted in each box varies considerably. Some growers prefer to sow the seed thickly (about 400 seeds). This method is satisfactory provided the plants are pricked off later into another seedling box or pot before the true-leaf stage. When sown too thickly plants are more likely to become drawn and spindly and are more difficult to handle when pricking out. Seed should be scattered evenly and thinly and covered with a light layer of finely sifted, sandy soil. Boxes should be watered through a fine rose and covered with glass with a sheet of paper on top. Seedlings should appear in from 7 to 10 days, when the covering should be removed. The optimum temperature range for germination and growth of tomato seedlings is from 60 to 65 degrees F.

Boxes for pricking out are prepared similarly to seed boxes and the soil is watered so that it is moist but not too wet. The seedlings should be handled carefully by the leaves and placed in the soil almost up to the seed leaves, about 2½in. each way being allowed between plants. Soil should be firmed gently against the roots with a small wooden dibble. If the weather is bright, the newly set out plants may need shading for the first day. Watering may be done the following day, but a fine rose should be used. Further waterings should be limited to just sufficient to keep the plants growing, as a relatively dry atmosphere will greatly reduce danger of frost injury and the risk of infection by fungous diseases.

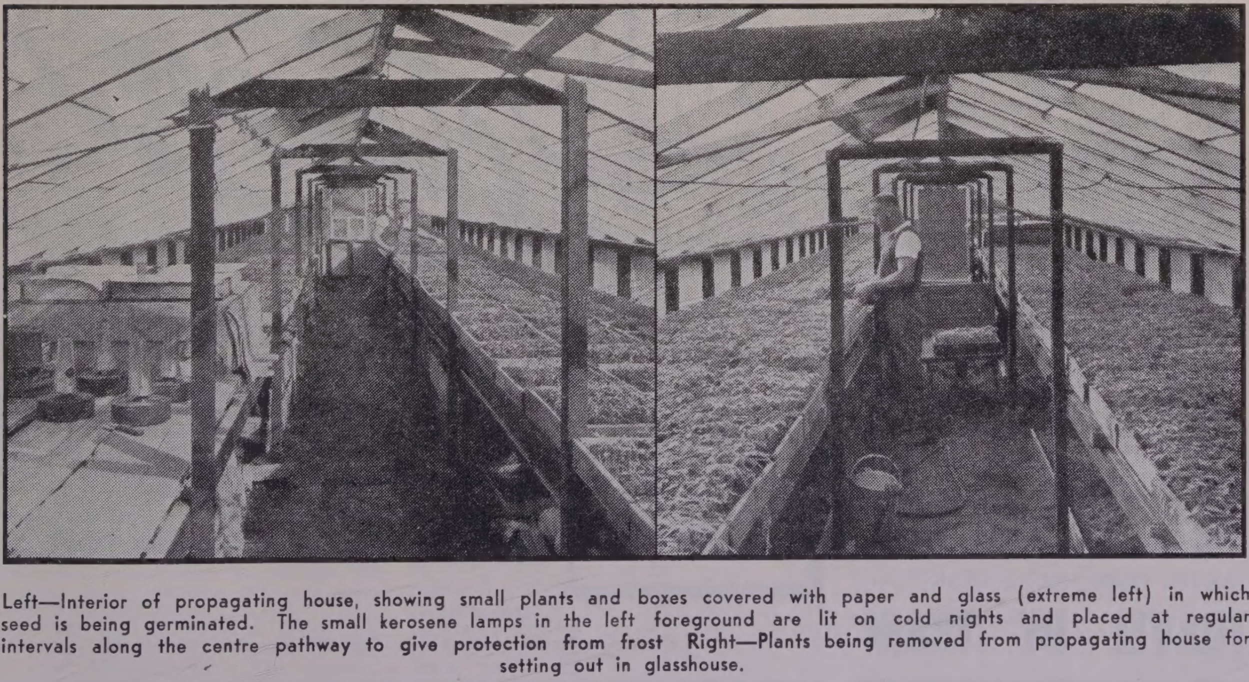
Later when seedlings are in the plant stage the temperature of the houses should be regulated according to the weather. This does not mean that the temperature must be changed every few hours, but that during dull weather the temperature should be lower; too high a temperature during dull weather will cause the plants to become drawn and spindly. Ventilation may be given on the lee side of the roof, but not to excess. The plants must be protected from draughts, which can result from badly designed ventilation systems.

Watering should be done sparingly through a fine rose (enough only to keep the plants growing). Too much water, especially in cold weather, will chill the plant roots and make conditions favourable for root rot and damping-off fungi.

It is important to grow good plants. They should be about 6in. high, stocky, dark green, and have an abundance of white roots. The appearance of the seed leaves is a good guide to a healthy plant. These should be green and turgid. Damage to the roots during pricking out or excessive wetness and coldness of the soil will encourage root rot organisms. The injured tissues are attacked by bacteria and fungi which are not so likely to attack healthy roots growing in soil that is suitably warm and aerated. If plants with root decay are set out in the house, it is most unlikely that a good crop will result, because the rot spreads slowly upward and usually causes trouble at some stage in the life of plants.

Overcrowding of the plants in the propagating house is not advisable, and before this occurs they should be removed to the glasshouse and left there with the boxes well separated until planting out time.

Some growers prefer to grow their plants in pots or plant frames (small, bottomless wooden containers). These are filled with the soil mixture used for seedling boxes and one plant is set direct from the seedling box into each container. This method has many advantages, the main one being that the plant roots have more room for development and are not unduly disturbed when being planted in the house. Consequently they establish more quickly and give a more uniform stand than plants taken from trays. The use of soil blocks is gaining popularity for the same reason. There is now a special tool on the market for



Left—Interior of propagating house, showing small plants and boxes covered with paper and glass (extreme left) in which seed is being germinated. The small kerosene lamps in the left foreground are lit on cold nights and placed at regular intervals along the centre pathway to give protection from frost Right—Plants being removed from propagating house for setting out in glasshouse.

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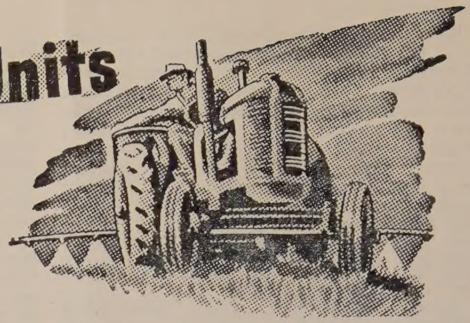

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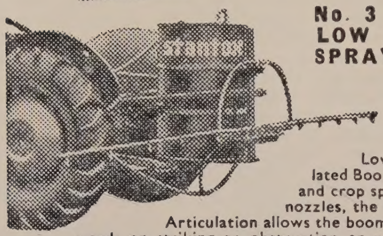

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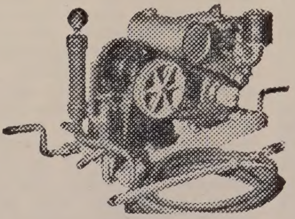

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making these soil blocks. The essential point is to use a good moisture-retentive compost.

Dates of sowing and planting: As these depend mainly on the prevailing weather, which varies so much in different localities, no definite time can be given. Generally plants are ready for planting out in the house about 6 weeks from the sowing of the seed, which should be timed to suit local conditions.

In the North Island, except for a few colder localities, heated houses are planted in May and June to produce a crop from September to December and most of the unheated houses in June and July for harvest from October to January. In the northern parts of the North Island, from Hamilton northward, a number of late plantings are made in the last week of February for production throughout winter, and the majority of these are in unheated houses. In the South Island, where most of the glasshouses are heated, planting usually takes place in July and August for harvest from November to February.

Although very early plantings are favoured by some growers of glasshouse tomatoes, these crops do not usually yield heavily, and are more or less a gamble and are deemed economic only because of the high prices obtained for early fruits.

Soil Preparation for Planting

If new glasshouses are to be erected on ground already in grass, it is best for this to be done without the turf being disturbed. If turf is worked up before building begins, the physical condition of the soil may be injured by continual tramping of it during building. It is advisable to cover the surface of cultivated land with straw, which can be worked into the soil when building is finished.

Manuring

The addition of 25 tons per acre (12lb. per square yard) of well-rotted animal manure or compost will ensure that the soil contains sufficient humus. In addition a basic dressing of 4 parts of "super. compound", 6 parts of bonedust, and 1 part of sulphate of potash should be applied at 2oz. to the square foot. For each 1000 sq. ft. the amounts required are 45lb. of "super. compound", 67½lb. of bonedust, and 12½lb. of sulphate of potash, a total of 125lb.

For houses that have been cropped over a long period application of 5lb. of sulphate of iron to every 1000 sq. ft. may be advisable.

Cultivation

Preliminary: The fertiliser should be well worked into the top 6in. of soil, preferably by rotary hoe.

Trenching: Double digging or trenching the soil to make it uniform to a depth of 12in. or more assists in preventing later trouble due to irregularities in soil depth and physical composition. During digging it may be necessary to loosen the subsoil.

It is a well-established fact that a deep, rich soil produces better tomato crops than shallow soils and it is of the greatest importance to see that the subsoil is in a suitable physical state for root development. Hard, closely compacted, cold subsoils or those that are too dry will not encourage favourable root development. The importance of this point cannot be overestimated, as there is a tendency to rely on manurial treatment as the answer to all soil problems.

Occasionally, however, the recommendations on soil working do not apply, and in old-established glasshouses the type of digging will depend on the nature of the soil. Generally, the more the soil is worked the better its condition will be, and although heavy soils should be trenched every year if possible, lighter soils that have been cultivated for 3 years or more will probably give as good a result if trenched only every third year.

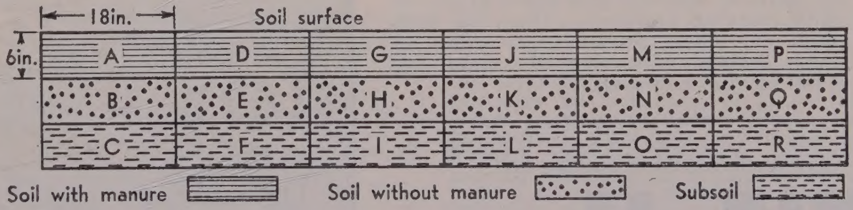
Mechanical cultivators of the rotary type are now used widely in glasshouses to chop up green crops, to aerate the soil after chemical disinfection, and to incorporate the base manurial dressing into the top 6in. of soil before trenching. A machine that will dispense with hand trenching has not yet been designed.

The correct way to trench is to divide the house into two equal parts, the central path being the dividing line. A trench 12in. deep and 18in. wide is opened against one of the end walls (say, the west) across one half of the width of the house (from the central path to the outside wall). The soil from this trench is laid on the path, the top 6in. spit being kept separate from the lower 6in. The bottom of the trench is then loosened up by forcing a garden fork into the subsoil and drawing the handle backward toward the operator.

To ensure an adequate supply of moisture in the subsoil the trench should be flooded with water. A fairly light soil or gravel subsoil may need flooding several times, but heavy soils should require only one flooding. To improve drainage the bottom and face of the trench should be covered with well-weathered straw.

The next spit is then turned into a trench, the top 6in. containing the manure going to the bottom of the trench and the lower layer without manure being placed on the surface.

Below is a diagram of the profile of a soil to be trenched.



Spits A and B are removed to form the first trench and are placed separately aside. C is then forked up as described. After the trench has been watered and the straw placed in it D is dug and placed over C and E over D. F is then forked, the trench is prepared, and G is placed over F and this routine is repeated until Q is placed in the position formerly occupied by M, leaving a trench above R at the east end of the house. This trench is filled by the soil from a trench dug on the other side of the pathway against the east wall, similar to the first trench opened against the west wall. The second side of the house is then trenched in the same manner, working back toward the west wall, the final trench being filled by the soil originally placed on the path from spits A and B.

Liming

The lime content of glasshouse soils is important. Lime is necessary to neutralise soil acidity, to release certain plant foods, and to improve the physical structure of the soil. The most generally used form of lime and the one suited for most soils is carbonate of lime. The annual requirement of most glasshouse soils is about ¼lb. to ½lb. a square yard according to the soil pH, but where doubt exists growers should consult the Horticultural Instructor for their district about the appropriate dressing.

A rate of ¼lb. a square yard requires ¼cwt. of lime to each 1000 sq. ft. To produce the maximum effect the lime should be sown on the soil surface after trenching and a sprinkler should be used to ensure that it is carried into the soil. The top 12in. should be thoroughly moistened. After the soil has been watered all doors and ventilators should be closed for about 2 weeks to enable the soil temperature to rise and hasten the decomposition of the organic matter.

Disinfection of Soil

To control soil-borne pests and diseases which, if left uncontrolled, would adversely affect the yield of the plants, several methods of treatment are commonly used. These include steam, chloropicrin, chloropicrin + D.D., and formalin. These soil treatments must be carried out before the plants are set, as later applications would cause injury to plants.

To be assured of good penetration of steam or chemicals through the soil it is essential that the soil should be finely cultivated to a depth of at least 12in. and that all strawy material in the soil should be well rotted. The moisture content of the soil must also be correct. To check this a sample of soil should be taken from a depth of 4in. and the soil when compressed in the palm of the hand should retain its shape. If it crumbles, it is too dry; if water exudes, it is too wet.

Soil temperatures for steam heating should be above 50 degrees F. and for chemicals not less than 55 degrees. When the soil is treated with chemicals which are toxic to plants it is necessary to fork it up to break the crust several days after treatment to allow the fumigant to escape. Wet or cold soils will retain the residual gases for much longer than warmer soils.

Steam Disinfection

When glasshouse soil is treated with steam it is necessary to have a boiler of 20 to 25 h.p. The size of boiler

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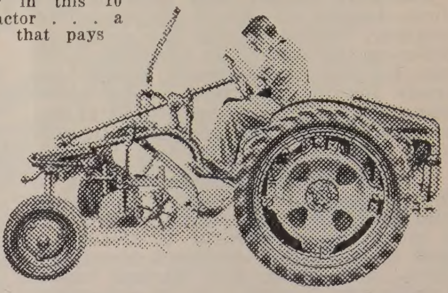

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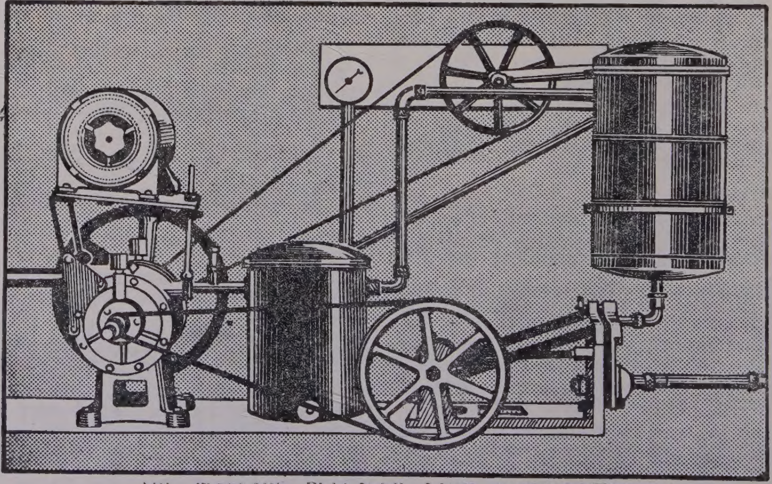

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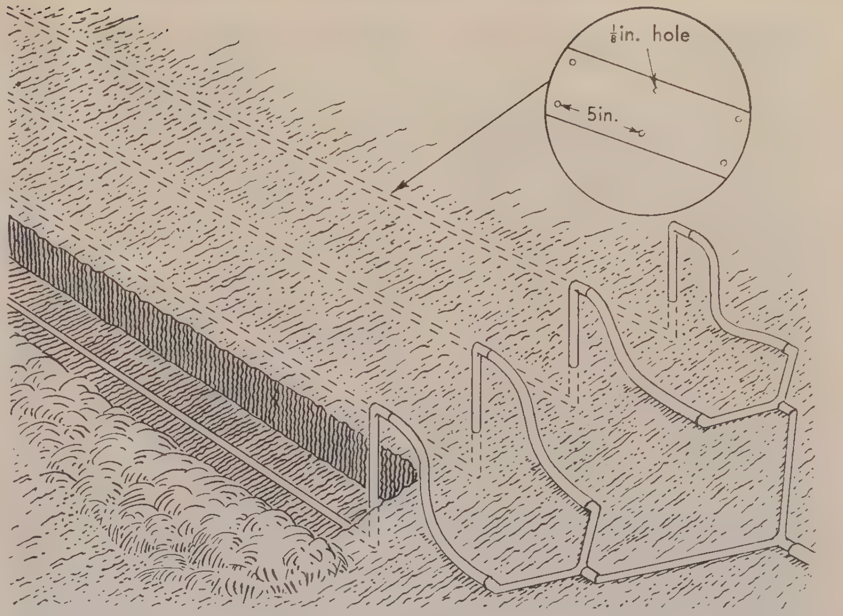


Hoddesdon pipe system of steam disinfection. Inset—System of holes in the underground pipes.

depends largely on how far the steam has to be taken. It is essential to have a boiler large enough to supply a continuous head of steam through a 1½in. pipe at a pressure of 80 to 90lb. a square inch. The following are methods of applying steam disinfection:—

Steam harrow: This equipment is used most commonly. It consists of a steam chamber 2ft. 8in. square and 1½in. deep of galvanised iron with 13in. long tines attached (see diagram below). The tines are of ⅜in. hollow piping with pointed ends and are arranged in 6 rows of 7. The harrows are usually operated in pairs to allow one to be shifted to a new area while the other is operating, thus saving any loss of time for the operator. The steam coming out of the ends of the spikes is retained in the soil by a tray until the soil has been subjected to a temperature of 180 degrees F. for 10 to 15 minutes. The harrow is then moved to an adjacent area and the area just treated is covered with sacks. Although this method is fairly satisfactory, it sometimes leaves untreated portions of soil near obstructions such as support posts and the steam does not penetrate the soil to a depth of more than 12 to 18in. Treated soil is readily recontaminated by disease organisms from any untreated areas.

Hoddesdon pipe system: The following information on this system has been extracted from "Tomato Diseases and Pests in New Zealand and Their Control" by J. D. Atkinson, R. M. Brien, E. E. Chamberlain, W. Cottier, H. Jacks, W. D. Reid, and G. G. Taylor of the Plant Diseases Division, Department of Scientific and Industrial Research, Auckland:—

"A newer method [of steam sterilisation] is the Hoddesdon pipe system, which allows the heating of the entire volume of soil without handicap from obstructions. This system consists of a number of pipes of 1¼in. internal diameter cut to desired lengths. One end of each pipe is closed with an iron plug; the other is fitted with an elbow and connected with a vertical pipe 2ft. long. The horizontal pipe is provided with two lines of ⅛in. holes at 5in. intervals drilled one on each side of the pipe and slightly toward the bottom. The shorter lengths of pipe stand up vertically in the soil during steaming and the top of the vertical pipe is fitted with an elbow and thread for hose coupling. Four of these pipes are joined by a connection consisting of three V pieces of 1¼in. tubing joined together by Y unions. Steam from the main hose enters the connection at the base of the first V, passes along the two arms to two other V pieces, follows the two respective arms, and passes through four lengths of flexible hose, which in turn are connected with the four vertical pipes.

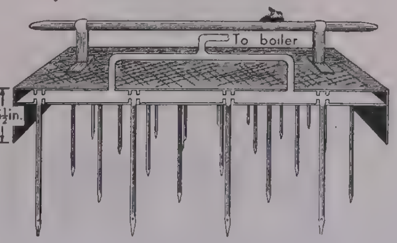
"This arrangement provides an even distribution of steam through the pipes. This method is applied in the following manner: A trench 18in. deep is dug along one side of the area to be treated and the spoil is removed to the other side. The bottom of the trench should be loosened with a fork to facilitate penetration of heat. The first pipe is placed close to the wall, the next parallel to it 20in. away. A second trench is dug, the spoil filling the first, and the same procedure is continued until four pipes 20in. apart are laid in position and covered. The surface is now covered with sacks and four pipes are connected with the steam hose. Another lot of four pipes is placed in position while steam is passed through the first four pipes. The operation is continued by pulling back the pipes into successive trenches dug behind them. Each steaming covers an area of an approximate width of 7ft. by the length of pipes and a sterilising temperature is obtained to a depth of at least 2ft. The time necessary for steaming varies with the soil type and moisture content, but 15 to 25 minutes are sufficient to raise the temperature to 200 degrees F. and above. In this system the digging of soil is carried out simultaneously with steaming.

"This method is suitable for all types of glasshouses, as the length of pipes can be altered to fit particular conditions. The pipes are easily removed, as they only need to be pulled back, and tramping on sterilised soil by workmen is therefore avoided."

Treatment of plant trays with steam: Plant boxes for the growing of plants should also be treated. They should be placed over the harrow or a steam pipe and the whole covered with a tarpaulin and subjected for 20 minutes to a temperature of 200 degrees F. Boxes so treated should be protected from reinfection when stored.

Chemical Disinfection

Although heat treatment is the best method of disinfection and the only one advised for the control of tobacco mosaic diseases, it is costly and as an alternative certain chemical disinfectants can be used satisfactorily to combat diseases other than tobacco mosaic. The best of these chemical methods are:—



Cross-section of harrow or grid commonly used for steam disinfection of soil.

Formalin: Commercial formalin (40 per cent. formaldehyde) is diluted with 49 times its volume of water and applied to the soil at 50 gallons per 15 sq. yds. To ensure efficient penetration the soil should previously have been brought to a fine tilth and be just sufficiently moist that when a handful is compressed it will retain its shape without soiling the hands. It is usual to take out a trench at one end of the house and water the sides and bottom with the necessary amount of formalin solution. The next spit is then turned into the trench, this soil and the sides and bottom of the new trench are watered, and so on throughout the area. Covering the soil with damp sacks for 48 hours after treatment will increase the effectiveness of the formalin. After 48 hours treated soil may be dug over to allow the fumes to escape; planting should not be carried out while any trace of formalin remains; otherwise seedlings may be damaged. It is usual to allow 3 to 4 weeks for complete aeration. Potting or seed box soil may be treated similarly, each 9in. to 12in. layer being soaked before the next is placed on top, and the whole covered with wet sacks. If the soil is in trays, it is usual to set out a row, water with the solution at approximately 5 pints per cubic foot of soil (roughly 2 pints per seed tray), place another row on top, water these and so on up to a convenient height. The stack is then covered with wet sacks or tarpaulin for 48 hours, after which the trays may be spread out to allow the fumes to escape.

Sowing or pricking out should be delayed until no smell of formalin is noticeable, usually after 2 to 3 weeks. Once the soil has been treated care

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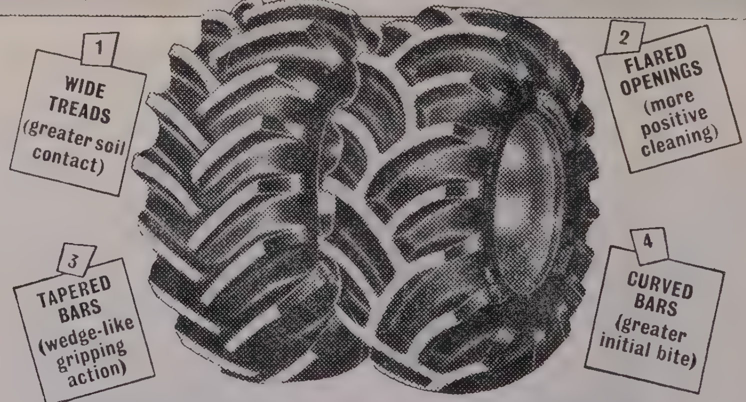
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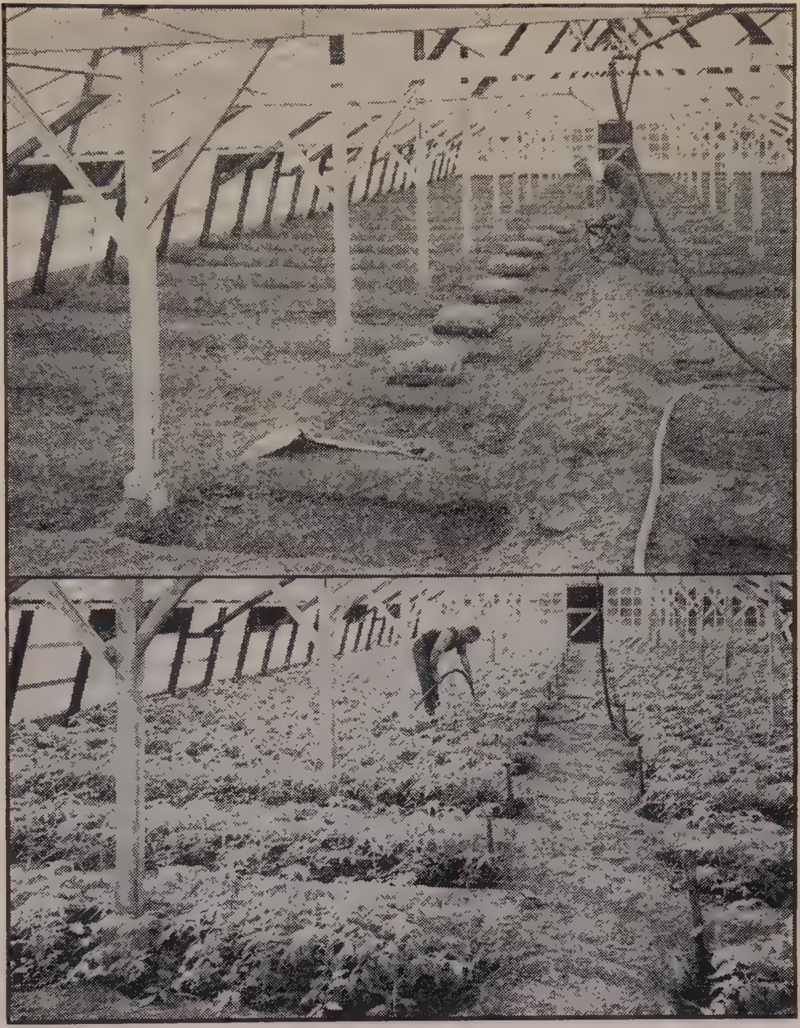


Upper—House prepared for planting, showing how plant beds are formed. The support posts are in the centres of the plant beds with two pathways between the support posts. Lower—House in upper illustration 3 weeks after planting, showing plants set out in double rows 18in. apart with plants 1ft. apart. The pathways are 2ft. wide and the plants are set 3in. in from the edges of the pathways. The stakes at the end of each double row prevent the hose from damaging plants when watering is being done.

should be taken to see that it is not reinfected from untreated soil, trays, etc.

Formalin controls fungous diseases effectively, but even at strengths greater than 1 in 50 it gives only partial control of eelworms. However, it delays their activity sufficiently to improve plant growth. A disadvantage of formalin is that the drenching of the soil tends to alter the physical structure, and extra cultivation is required to restore the tilth.

Chloropicrin acts both as a fungicide and an insecticide, appears to improve plant growth, and gives partial control of weeds. It is best applied with a special injector by which the depth and the dose can be regulated, but a dibble and a graduated burette can be used for a small area. The dose and the depth are varied according to the type of soil, heavy soils requiring a greater dose at less depth than light soils. The ground should be well worked, free from lumps, and slightly damp before treatment; wetting of the top ½in. of soil before chloropicrin is used will reduce the unpleasant effect of the fumes. The area is marked out with lines 1ft. apart and 2 to 5 millilitres (1/15 to 1/6 fl. oz.) of chloropicrin is injected at a depth of 4 to 8in. every 12in. along the lines, the first injection being made 6in. in from one edge of the house. The holes should be closed immediately to prevent the gas escaping. A further watering at 1 to 1½ gallons per square yard is recommended to seal the surface. Ventilators and doors should be open during treatment, but immediately after they should be closed and the soil left undisturbed for 48 hours afterward. The area can then be forked over to aerate it and should be ready for planting in 1 to 2 weeks.

Chloropicrin is not satisfactory for soil in trays, but loose soil can be treated in drums, barrels, or boxes. The disinfectant is injected at varying depths to ensure thorough penetration and the containers are covered with wet sacks or tarpaulins for 48 hours, after which the soil should be thoroughly aerated before use. The rate of application varies with the type of soil; 3 millilitres per cubic foot should be allowed for composted soil, 5 millilitres for ordinary soil, and 10 millilitres for clay loam. The gas will permeate the soil 5 to 8in.; the number and spacing of injections should be calculated on this basis.

Killing of weed seeds is improved if the soil has been watered about a fortnight before chloropicrin is injected and kept at a suitable temperature to encourage germination.

Chloropicrin should be stored in a cool place, preferably in glass or thick metal containers. As it decomposes cork and rubber stoppers, metal or plastic tops should be used. It is not inflammable, either in the liquid or gaseous form. If chloropicrin is spilt on the skin, it should be rinsed off with soap and water, because it can cause inflammation. It is advisable to use a gas mask when filling the injector, as chloropicrin causes smarting and watering of the eyes, and, when inhaled, violent coughing.

A pound of chloropicrin is sufficient to treat 90 sq. ft. at a rate of 3 millilitres per injection. A level teaspoon contains 5 millilitres.

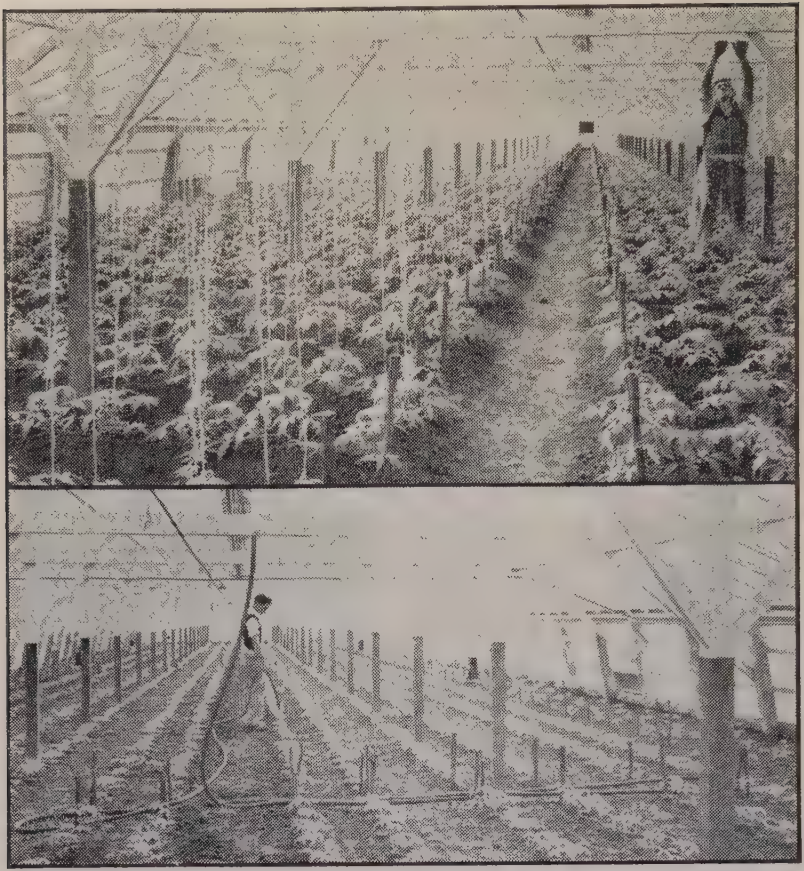
D.D.: This fumigant is economical to use and will control eelworm and soil-borne pests. It is also useful against damping-off and wilt diseases and will kill a fair percentage of weeds. Methods of application for potting soils and soils in situ are the same as described for chloropicrin. After treatment 3 to 4 weeks should be allowed before plants are set out, as this fumigant remains in the soil longer than chloropicrin. It is less volatile and requires no water seal after the soil treatment.

Levelling and Marking

Levelling is essential for even distribution of moisture and ease of planting. The soil in each bay should be levelled separately, a bay being the area between two support posts and the central path and outside wall, roughly 8ft. x 14ft., but varying with the size of house. A piece of 4in. x 2in. timber (straight edge) with spirit level attached and long enough to reach from the path to the wall is laid level down the middle of the bay and the soil raked level by eye judgment on each side. Each bay is levelled in turn.

Marking: Measurements depend on distance between support posts (see the table in the section on plant and row spacings on page 403). If posts are 8ft. apart, the plant support wires are 18in. apart with 30in. between pairs of wires. The support posts should be midway between the 18in. spaces so that they do not block the lateral paths.

A 2ft. 6in. pathway is left down the centre of the house and the area on each side is marked with lines 24in. apart at right angles to the pathway. Alternate 24in. spaces should correspond with the pairs of overhead wires. The soil from alternate spaces is scooped out with a flat-mouthed shovel to make wide trenches 3in. to 4in. deep and the spoil is spread evenly on the intervening spaces. This operation forms plant beds and paths, the



Upper—Unheated glasshouse which runs east and west. Plants are set in single rows across the house. Rows are 27in. apart and plants 12in. apart. Plants are being tied to support wires. The stakes at the ends of rows protect plants from damage by the hose during watering. Plants were set out on the flat and the soil was ridged up to them later. Lower—Unheated glasshouse which runs north and south; therefore plant rows run lengthwise. Support posts are between plant rows and do not obstruct pathways. With this method of planting the main paths run lengthwise of the house, and to facilitate working several pathways are also left at intervals across the house. Short stakes are placed on each side of these cross-paths, one at each end of plant rows, to guide the hose and keep it from damaging the plants during watering. Plants are set out on the flat in double rows 18in. apart and are spaced 15in. apart. There is 33in. between each set of double rows. Kerosene heaters on each side of the house are used on cold nights as a protection against frost. They are spaced at regular intervals 3ft. in from the walls, one heater to about 500 sq. ft.

paths being raised slightly above the beds. The centre path is raised to the same level as the lateral paths.

The beds are then marked out for planting. The planting lines should run parallel down each plant bed 18in. apart and 3in. in from the edges, bringing the lines directly below the wires. The plant holes are made along these lines 12 to 15in. apart, the first hole 6in. in from the central path.

Plant holes are sometimes made with a dibble consisting of an iron bar with a mould at one end and handle at the other. This is thrust into the ground, given a half turn to left and right, and withdrawn, leaving a clean hole.

Planting

The plants are removed from the boxes, which should have been well watered 12 hours previously. Each plant is carefully taken out by hand with the soil adhering to the roots and placed with as little disturbance of this soil as possible into a prepared hole. The soil is then firmed around it.

In this operation plant roots should be damaged as little as possible, as damage to roots will facilitate the entry of harmful soil fungi. The old method of cutting plants out of seedling boxes with a knife or trowel is no longer practised.

Water should not be applied at planting. If the soil has dried out, watering should be carried out a few days before planting to avoid the possible reduction of soil temperature. If, however, the soil has been steam sterilised and consequently is still very warm, water can be applied if necessary without causing unfavourable results.

To ensure good development of plants after they have been set out temperature should be maintained at between 70 and 75 degrees F. In an unheated house it is not always possible to achieve this range, but the difference between day and night temperatures should be kept to a minimum. Temperature fluctuations of more than 10 degrees are not favourable for best plant development.

Watering

During the first 3 weeks after setting out, plants will require very little watering and any water given should be directed into the shallow depression round each plant and so straight on to the balls of the roots. When plants become well established and the roots extend normal watering may begin. Times between watering will depend on the texture of the soil. Too little water may cause the flowers to drop and later may make the plants poor and weak. Over-watering encourages root rots and soft growth, which are particularly dangerous when plants are young; hence great care is necessary with early watering. On very light soils, which tend to dry out quickly, a mulch of straw or strawy manure given when the first truss begins to ripen will reduce surface evaporation and hence the amount of water required.

It is difficult to judge the exact day to begin the main watering; if water is applied too soon, growth will be too succulent, but if it is delayed too long, setting of the flowers may be adversely affected. Generally, watering can be done with reasonable safety if delayed until the flowers on the second truss have set, as then the swelling of the fruit will help to counteract the softening effect of watering. Where plants are set out later in the season or for autumn crops it will be necessary to water at an earlier stage of growth.

The condition of the flowers is a clear indication of the plant's moisture requirements; if these are robust and a good, bright yellow and the truss stalk is dark green and turgid, water is not needed. If, on the other hand, the flowers are dull and pale and the stalks grey, water is necessary. If the flowers are falling off, water is needed urgently, but experienced growers seldom allow plants to reach this stage.

To ensure that plants are receiving adequate water the soil should be examined frequently. A sample of soil taken from a depth below 4in. should be squeezed in the palm of the hand; if water is exuded, the soil is too wet and if on release the soil crumbles, it is too dry. The moisture content is correct when the soil retains its shape after being pressed.

If water is required, it should be given in sufficient quantity to wet the soil to a depth of at least 1ft. and is best delivered by large-diameter hose at low pressure. If the delivery is fierce and is likely to wash the soil, a "sock" (a piece of material that will allow water to flow freely through it) should be tied to the end of the hose. To prevent damage to plants when the hose is being moved during watering short stakes are placed on each side of the centre pathway, one at the end of each row (see the illustrations above).

Watering should make the soil uniformly moist. The hose should be kept close to the ground to avoid splashing the plants. Whenever possible watering should be done in the mornings to give the soil time to warm up again before nightfall.

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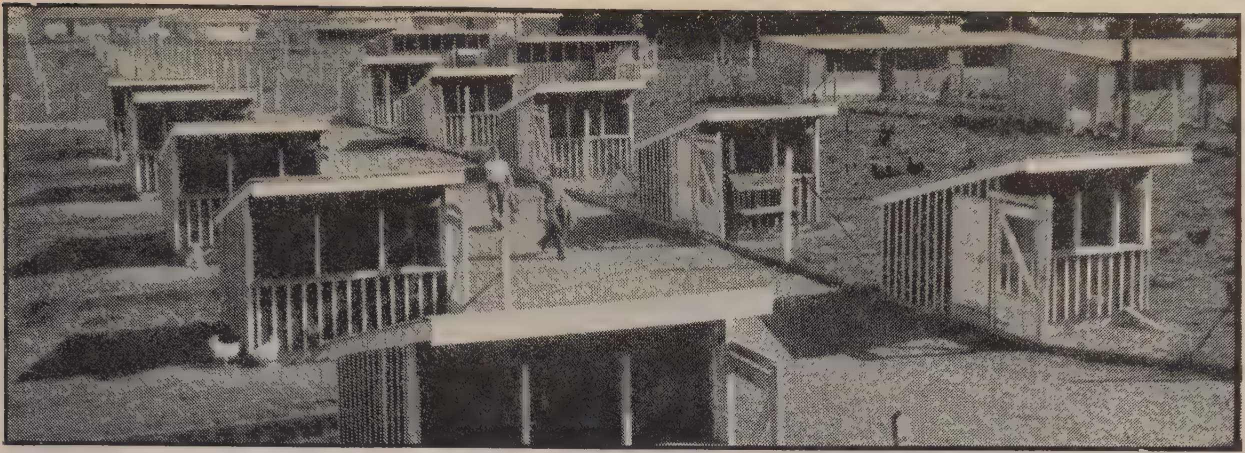


Improvement of Poultry Stock

DURING the last few years an aim of the Department of Agriculture has been to assist poultry farmers throughout the country to improve their flocks by accrediting their breeding stock under the New Zealand Poultry Flock Improvement Plan. It is essential that all poultry farmers, whether supporting this plan or not, should concentrate on improvement of their breeding stock, and in this article W. G. Proudfoot, Poultry Instructor, Department of Agriculture, Dunedin, advises on management practices which will help to do this.

THE main aim in poultry breeding is not the breeding of egg producers only, but rather of stock that can live and resist disease as well as produce eggs, and also possess the vigour and stamina to reproduce their kind. Successful poultry farmers with years of practical experience in the art and science of mating birds know that most problems and troubles begin in the breeding pens or flocks. Poultry breeding is as intricate as any branch of animal husbandry and requires as much aptitude, study, and concentration.

Quality Not Quantity

Poor-quality breeders should be eliminated. It is false economy and wasteful to hatch out 20 or more chicks from an inferior or undesirable hen and to begin culling them immediately. It is even more wasteful to mate a poor cockerel with a pen of good hens and find later that the offspring are only mediocre. Before mammoth incubators were used farmers were much more careful in the selection of their breeding stock and a number always used single-pen matings. This meant the rejection of all second-class birds, and every bird was individually handled for selection, very often being trap-nested. Farmers then developed the practice of mating small flocks of 20 to 25 hens with a couple of male birds. These flock matings used second-preference hens. There is no doubt that the stamina and type of flocks even 20 years ago were superior to the general average today.

The increase in the industry has called for more and more chicks. This in turn resulted in larger incubators, and consequently more birds had to be mated to fill these machines. As a result the rigid selection of breeding stock declined, and a percentage of the resultant chicks came from parents really below the desired standard. There have been farms where practically every bird has been mated to supply the fertile-egg needs. Now it is most difficult to find any flock which is 100 per cent. fit and suitable for breeding. The aim of many poultry farmers for years has been quantity instead of quality. Emphasis should therefore be on breeding only from the best.

HEADING PHOTOGRAPH: Single male bird breeding pens used at the Department of Agriculture Poultry Demonstration Plant, Upper Hutt, under the progeny testing breeding programme.

Points in Mating

There are several ways of selecting breeding stock. Consideration might be given to any factor such as pedigree, the dominant blood line, the physiological matings, the common-sense matings, and the speculative matings. Even under the best of judgment, or whatever lines are followed, a measure of speculation always exists. A breeder may possess a dominant blood line and while that lasts all is well, but unfortunately even dominant blood lines can fade away. Very rarely can a breeder retain a dominant pedigree blood line in the utility class for more than 3 or 4 years.

In the mating of a breeding pen very careful consideration must be given to each fowl that is to form part of it, if the progeny is to come up to one's hopes. The only fowls chosen should be those of sound constitution and which have never had an illness, are alert with bright eyes, and show every sign of good health. Preference should be given to bald-headed females. The breeder must be sure that all members of the breeding pen are free from serious faults and are as true to the type of breed as possible. Therefore it is important to know the standard of perfection of the breed which is being dealt with. The flock as a whole should be typical of the breed.

The male bird must be healthy, up to standard weight, free from serious faults, and as typical as possible. He must carry himself with a lordly air and "handle" firmly. Should he have any slight fault, this must be noted and care taken that it is not also present in the females of the pen. A rigid rule in mating is that weakness in one sex should be counterbalanced by strength in the same feature in the opposite sex. Selection such as is suggested here is impossible where only flock matings are carried out. Therefore the wise farmer will have small pens which hold, say, 50 pullets. These he will watch carefully, culling where necessary throughout the laying season, with the result that he will have perhaps only 20 birds in each pen at the end of the season. Out of these groups of 20 birds he will pick the best and mate them to his best male birds. It is from these pens that

[*Green and Hahn Photography Ltd. photo.*
Head of a White Leghorn male which shows quality, strength, and constitution.

A table bird mating with a Light Sussex male and Rhode Island Red females. Health and vigour are just as important for this type of mating as for that aimed at egg production.

he should select his cockerels for his future flock mating.

Age of Breeding Stock

Pullet breeding should be avoided unless circumstances are exceptional. A farmer breeding from a pullet is to a very great extent working in the dark, since he has no knowledge of her productive ability or whether she is capable of withstanding the strain of heavy egg production; that is to say, whether she has inherited that very valuable factor liveability.

All the arguments in favour of breeding from hens only apply equally to the males, for it is beyond dispute that a second- or third-year male who has proved his worth in the breeding pen is of far greater value than an untried cockerel. Older males are not usually as fertile as cockerels and therefore will not produce so many chicks, but what they do produce should be of first-class quality provided the progeny of their previous matings has been tested. Whatever system of breeding is to be used in 1953 it should include as many of the tested adult cocks as possible. When three generations of a male line can be shown alive at the same time there will be little wrong with the strain.

Management of Breeding Stock

The foundation of a successful breeding season is laid months before by the resting and preparation of breeding stock during early autumn and winter. It is fatal to try to produce good breeding stock from fowls that have already done more than their fair share of production. Where dams have insufficient stamina to stand up to heavy egg production over a long season poor-quality chicks may result unless the dams take a complete rest during the moulting period.

The importance of an enforced rest from production before a breeding season cannot therefore be overemphasised. Tired stock will not produce progeny of high quality, nor will fertility be high. The domestic hen has been artificially bred to produce an unnaturally large quantity of eggs, and there is a tendency to push and force her to produce even more and more eggs, with the frequent result of wearing her out in her first breeding season. But if she is forced to take a rest before the breeding season, she will for years produce large numbers of healthy, productive progeny. Change of ground and a low plane of feeding force poultry to take a natural rest. A commercial egg producer may not be able to afford to give his fowls this rest, but he should not then try to breed his own stock, but should leave that to the man who makes it his business.

A great deal remains to be learnt about the management of breeding stock, and the experiences of good practical breeders must largely be relied on. The pure scientist may sometimes be reluctant to place very much stress on the experiences of breeders, as their conclusions are necessarily drawn from practical observation and not from carefully planned experiment. However, the good breeder is observant and his practical experience deserves recognition.

Breeding is still largely an art; the secret of success does not lie entirely in being able to make correct matings. Rather does it depend on sound management of stock from the time they are a day old. The breeder should as far as possible keep his stock in natural conditions at all stages. For example, allowing fowls outside is a very safe and relatively inexpensive insurance policy, for stock with access to grass will make up for any minor deficiencies in their diet.

It is important to give a little extra feed to male birds and this is done most successfully by feeding the male birds away from their hens. Vigorous males give a great deal of attention to the females by standing aside and allowing them to have the best of the food. The males thus go down in condition. Very often this is not noticed by the farmer until it is too late.

Progeny Testing for the Breeder

The value of progeny testing for production and stamina has been fully demonstrated and is receiving more and more attention from the modern poultry breeder. Possibly some will say that universal progeny testing is the ideal of the dreamer. This may be true; but progeny testing by the breeders, to whom the commercial men must turn sooner or later, is probably desirable. It will mean more work, more records to keep, more culling, but there appears to be no alternative. It is a wise breeder who perseveres with progeny testing, not only to improve production, but also to concentrate on those lines which apparently have the ability to live and resist disease.

Rhode Island Red male and female, both showing health, vigour, and size.

Royal Farming on the Lands of Windsor

By JOHN HARRIS

THE use of modern methods in a setting rich in ancient traditions may be said to epitomise farming in Britain today, and nowhere is this better exemplified than on the Royal lands of Windsor. There an electric milking parlour adjoins the Victorian dairy and a combine harvester rolls over land that had not been ploughed within any man's lifetime.

THE home farms around Windsor Castle are the personal property of the Sovereign. Prince Albert established Shaw Farm in 1840, and Queen Victoria's Dairy, on Prince Consort Farm, was built in 1851. This was the time when Queen Victoria and her Consort were pioneers of farming, and they made Windsor not only a centre of stockbreeding but a testing ground for new methods.

The walls of Queen Victoria's Dairy are tiled, and on marble tables are still preserved the Crown Derby setting pans. Under the tables ran water for cooling, the water being supplied by a fountain that played at the Great Exhibition in London in 1851. The Prince Consort was a farmer with advanced ideas.

From Beef to Milk

This model dairy handled the produce of the famous Windsor Jersey herd, and the herd is still at Windsor today. Despite this, the emphasis in the last century was really on beef cattle. The Royal favourites were the great beef breeds—Shorthorns, Angus, Hereford, and Highland cattle.

A big change in farming practice on the home farms has been to end beef rearing and feeding and to concentrate on dairy cattle. In addition to the Jerseys Queen Elizabeth II has started a herd of Ayrshires. They were mainly bought in 1951 as heifers. They came from English and Scottish herds and a draft has since come from the Queen's own herd at Balmoral in Scotland. The cows are attested and all are good milkers.

Both the Ayrshire and Jersey herds are kept in courts or covered yards. The Jerseys are milked by machines on wheeled platforms. To watch the Jerseys lined up for milking in the spacious cowshed was a special delight of King George VI. When at Windsor Queen Elizabeth also likes to see them being milked.

The Scottish Shorthorns have gone to Sandringham, but in the former cattle yards are now housed a thousand poultry. These Sussex-Rhode Island Red cross birds were bought as day-old chicks. At the beginning of the year all were laying at the 60 per cent. level. A fair number of cockerels are fattened at Windsor, and in this

Cockerels are produced in considerable numbers on the Royal farms at Windsor, in Southern England, and 500 are being fattened in the folds for State banquets at Coronation time. In the heading photograph a tractor is shown hauling silage from a clamp. About 250 tons of grass silage was made on the farms in 1952 and this has now replaced kale as the succulent food for the Ayrshire herd.

The Queen's Cup

HER MAJESTY THE QUEEN has presented a silver cup to the Royal Counties Agricultural Society which will be awarded to the owner of the best herd of dairy cattle in Surrey. The name of the successful farmer will be announced at the Royal Counties Show.

Traditionally this dairy herd competition is for cattle in the county where the show is held, and normally it would be Hampshire this year. Surrey farmers, however, could not compete last year, when the show was at Guildford, because the competition was cancelled by foot and mouth disease outbreaks. Hampshire farmers participated as recently as 1951, when Southampton was the venue, whereas Surrey farmers have not competed since 1932.

Coronation Year many will be sent to table for State banquets.

Considerable acreages of grain are sown, mainly for stock feeding, but from last year's harvest some barley was sold for malting. Wheat and barley this year occupy 180 acres of the 650 acres which comprise the home farms. The policy is to take the plough round the whole of both farms, with grassland based on a lea of about 3 years' duration.

Reclaiming Windsor Great Park

The Royal farms adjoin Windsor Great Park. Though the Park is administered by the Commissioners of Crown Lands, major policy decisions rest with the Ranger of the Park. In this capacity King George VI inspired some remarkable improvements.

During the Second World War Britain was dependent on keeping her sea lines open for essential supplies and it was imperative to grow as much food as possible at home. Most of Windsor Great Park had never been under the plough, and even an enclosed part had been under grass since 1870. King George decided in 1941 that as much of the land as possible must be farmed.

Oaks, some of them 800 years old, were uprooted. Ploughs cleared away the bracken. Now some 2000 acres have been reclaimed to yield bountiful crops.

In addition to this big arable area in the Park there is a dairy herd of more than 50 British Friesians and 500 steers of the same breed on 600 acres of rough parkland. The steers, after they reach 6 months, are out summer and winter and are mostly graded straight off grass at 3 years. They grade well.

Next year the Royal Show will be held in Windsor Great Park; the show was last held there in 1939.

Dairy Farmers' Meeting at Massey College

THE annual 4-day meeting of dairy farmers organised by Massey Agricultural College will be held from the afternoon of Tuesday, 9 June, to the morning of Friday, 12 June, inclusive, and will this year precede the sheep farmers' meeting from 23 June to 25 June inclusive.

Subjects in the programme include bloat in dairy cows, chemical control of pasture weeds and insect pests, the role of potash among the more important fertilisers, farm trees and hedges, the development of artificial breeding in New Zealand and the results already obtained from it, the value of pedigree records and sire surveys in the selection of dairy sires, problems in calf rearing, developments in the pig industry, and agricultural education.

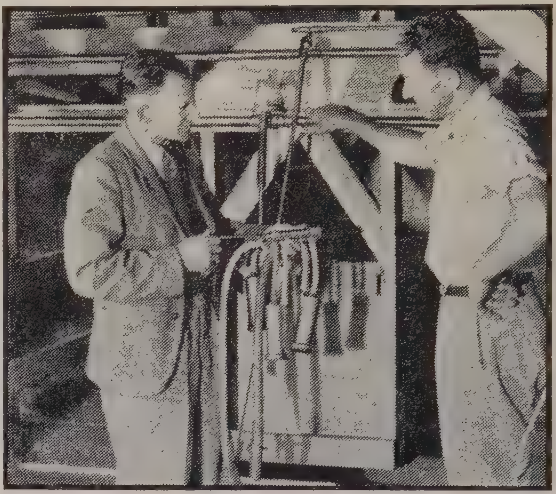
There will also be an open forum, a visit to the Massey College dairy farm or the Grasslands Division, and a demonstration of milking shed equipment and ways in which the safety margin in manipulation of farm tractors may be more readily assured.

Programmes may be obtained from the Registrar, Massey College.

Detergents for Cleaning Farm Dairy Equipment

THE field trials and experiments conducted by the Dairy Division of the Department of Agriculture in its search for a detergent likely to suit all requirements in cleaning milking machines and associated equipment have confirmed the results of the short-term and technical trials carried out by the Animal Research Division and suggest that the B type formula introduced by W. G. Whittlestone, of the Department's Animal Research Station, Ruakura, will be the most suitable.

The objective has been to build a detergent which will remove fat from the surface of rubber and thus prevent its accumulation in the rubber, retard the formation of milkstone and mineral stone on metal, remove fat deposits from utensils, and be generally effective in any of the classes of water available for cleaning on dairy farms. Detergents made to the B type specification have proved very effective where the water supply is very hard.



[*National Publicity Studios photo.*

Following are specifications of the Ruakura B type detergent:—

	Per cent. by weight
Sodium meta silicate	20 to 30
Sodium hexa meta phosphate	10
Approved wetting agents* or combination of wetting agents	15
Soda ash	45 to 55

* The wetting agent should contain not less than 25 per cent. of active material. A list of approved wetting agents or combination of wetting agents can be obtained from the Director of the Dairy Division.

It has been found that the most effective cleaning is obtained by using an acid detergent in conjunction with the alkali-built detergent. The method advocated is to use the alkali detergent twice daily for 6 days and the acid detergent on the seventh day of each week.

The specifications in percentages by weight of a suitable acid detergent for use in the manner prescribed are: Citric acid 30, wetting agent 15, water 55. (The wetting agent is to contain not less than 25 per cent. of active ingredients.)

Manufacturers and distributors of farm dairy detergents using the B type specifications may state on the container labels and in advertising material that the detergent has been made to these specifications, which are approved by the Animal Research Division and Dairy Division of the Department of Agriculture. It can also be stated that the detergent is recommended by the Dairy Division. A provision with regard to the use of both statements is that there must also be included on the labels and in the advertising matter the statement that the preparation "**is guaranteed** to comply with the Ruakura B type specification". Further, labelling and advertising material should be submitted to the Director of the Dairy Division for approval before it is used. The formula adopted should also be supplied. Any formulas so supplied will be treated as confidential by the Department.

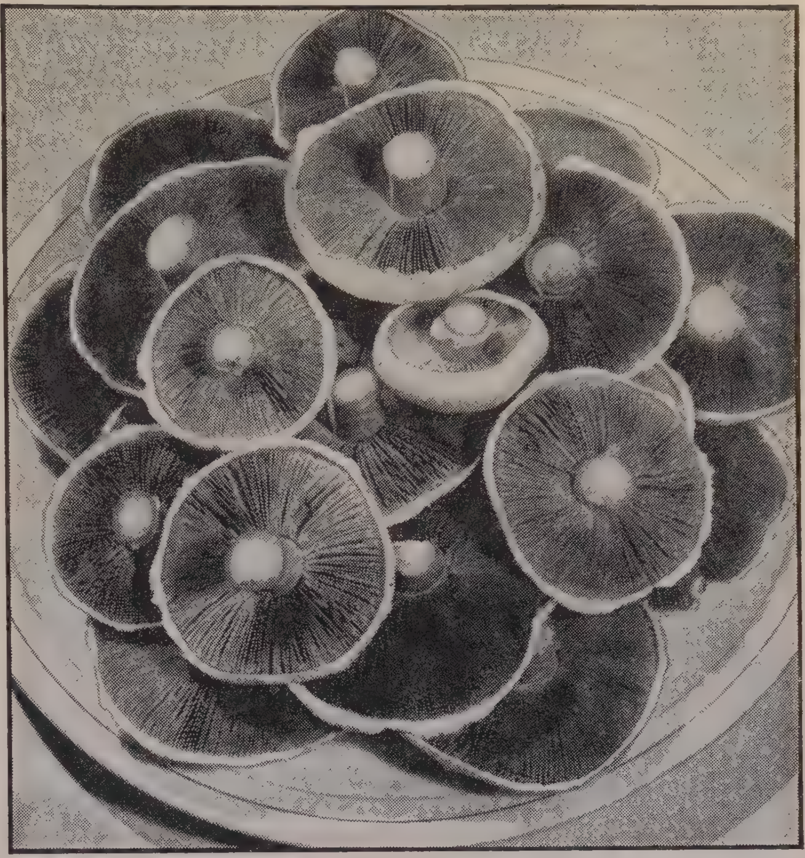
Dairy farmers should therefore feel assured that detergents carrying the Departmental recommendation are suitable for the cleaning of their dairy equipment.

The Dairy Division has for many years recommended the use of caustic soda for cleaning milking machines and for those farmers who prefer to continue the use of caustic the following method is recommended:—

Caustic soda as ordinarily specified in the past (one heaped teaspoonful per 3 to 4 gallons of boiling water) should be supplemented by the addition of a small quantity (at least one teaspoonful) of a suitable wetting agent or of a soda ash mixture containing a wetting agent. To get the best results the wetting agent should be put into the boiling water before the caustic soda is added; the full benefit of the caustic soda can then be obtained in all types of water.

The Home Garden in June: Growing Mushrooms

THE home gardener's primary aim should be a well-regulated supply of fresh vegetables at all seasons, but it is profitable and interesting to extend the field if possible. This article by A. G. Kennelly, Horticultural Instructor, Department of Agriculture, Dunedin, discusses the growing of mushrooms, which are a popular food, though a delicacy which is probably less freely available in many parts of New Zealand than was so 20 or more years ago. The section of this article on routine work in the home garden is by C. L. Napier, Horticultural Instructor, Department of Agriculture, Hastings.



THOUGH the mushroom is valued as an article of diet in New Zealand, few home gardeners have attempted to grow it. Its popularity and the quality of the produce that can be grown from spawn obtainable from most good seedsmen merit the attempt to grow it where suitable facilities are available. There are a number of wild species of edible fungi in New Zealand of which probably the best known is the field mushroom (*Psalliota* (*Agaricus*) *campestris*). In the past the cultivated mushroom has been classed as a variety of the field mushroom, but recent research indicates that this is unlikely and despite obvious morphological differences it may be more nearly related to the horse mushroom (*P. arvensis*), though most people with experience of the fine texture and flavour of the cultivated mushroom will agree with those authorities who consider it deserves classification as a distinct species. Usually there are available two varieties of the cultivated mushroom, a cream-coloured to almost light brown variety and a white variety.

Together with yeasts, moulds, and mildews, mushrooms belong to that great group of plants known as fungi. The fungi as a group may be considered the scavengers of the vegetable kingdom, for they seize on all dead and decaying vegetable matter and soon reduce it to a condition in which it can again be utilised by plants. Fungi which obtain their food from living plants or animals are called parasites, and those which derive their food from dead plant substances are called saprophytes. Fungi cannot make their own food as green plants do, because they lack the green chlorophyll by which ordinary green plants are enabled in the presence of sunlight to promote the union of carbon dioxide and water to form sugar, which the plant further builds up into starches and other substances for its growth. Fungi on the other hand are able to live without light.

Fruiting Stage of Fungus

What is commonly called a mushroom is not truly a vegetative body, but is merely the fructification (fruiting stage) of a fungus. As the mushroom fungus has no flowers, it produces no seed. It reproduces its kind by means of minute bodies called spores, which are formed on the gills under the "cap". The cycle of life of the mushroom fungus can be divided into three stages: 1 spores, 2 mycelium (spawn), 3 mushroom.

Spawn may be obtained from most good seedsmen in either "bricks" or in bottles. The bottle method of carrying spawn is the more modern method and is claimed to give a product that is much purer and truer to name than brick spawn; in addition, because it is usually fresher and moister, it starts growing much more rapidly when planted and is less likely to fail.

Brick spawn is made up of hard, dry blocks of compost usually about 8in. long by 7in. wide by about 1½in. thick and is full of threads of mushroom spawn.

Culture

Mushrooms are not easy to grow. The only sure way of growing them is the standard method, in which beds of fermenting horse manure are spawned under controlled and strictly hygienic conditions. It is possible to grow mushrooms outside in open paddocks, but there is no certainty in the method. On occasions, however, if a good turf paddock is available, the method is worth trying on a small scale. The spawn can be planted below the turf either with or without manure, though there is more chance of success where manure is used. The manure should be prepared in the same way as for the standard-type bed.

November to February are the best months, but in the north spawning could take place even later. The usual method is to take out slices of turf about 1ft. square with about 1½in. of soil adhering to them. About 3in. to 4in. of soil is removed and prepared manure is pressed firmly into the cavity. The manure should be spawned according to the spawn-maker's directions and the turf replaced and firmed so that there is no trace of its having been lifted. The plantings should be not less than 2ft. apart.

If spawning is followed by continuous dry weather, the spawned areas should be watered to keep the cut turf moist and alive, but where manure has been inserted watering should be applied with discretion, for the manure underneath should not be made wet. Though much depends on weather and the condition of the turf, mushrooms may be expected in from about 6 to 10 weeks, but occasionally the period is longer.

Growing Mushrooms in Beds

Though the only reliable method of growing mushrooms is in properly prepared beds of fermenting stable manure, correct preparation of the manure before it is made up into the bed is of great importance. Mushrooms can be grown in cellars, wooden

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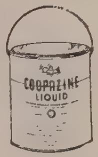

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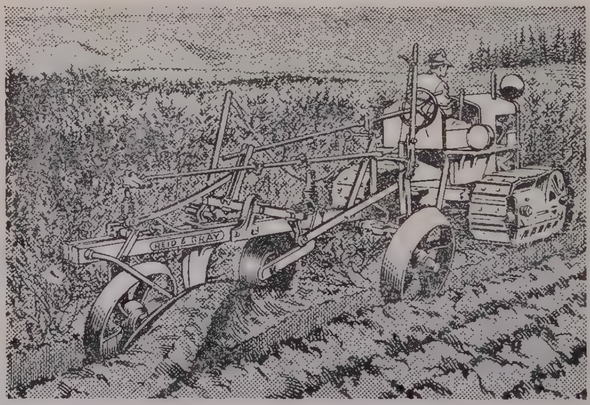

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sheds, glasshouses, frames, stables, or almost any place where equable temperatures can be maintained and draughts excluded; beds can even be made up outside in favourable weather. Worked-out mines, tunnels, catacombs, and quarries are also used overseas.

For the first few weeks after spawning it is not advisable to allow the temperature to drop below 50 degrees F. This is to ensure that the spawn runs freely in the beds. Once it has run the temperature can drop very much lower without doing any harm beyond retarding growth until the temperature again rises. For best results temperatures should not rise above 70 degrees F. The higher the temperature is above 65 degrees the greater is the likelihood of moulds and rots developing and destroying the crop. Probably the ideal temperature is between 54 and 58 degrees F. Fluctuating temperatures are very harmful, and variation should not exceed 3 or 4 degrees on either side of this.

If a glasshouse equipped with hot water pipes is available, the heat may be used if required, but kerosene or gas heaters are not recommended, as the fumes are often harmful. The air should preferably be fairly moist, but not excessively so.

Light is neither harmful nor beneficial, but sunlight is best excluded, as it is accompanied by some heat and thus has a drying effect. Fresh air is essential, but direct draughts must be excluded. The air should be gradually and constantly changed, but no special provision of ventilation should be necessary for mushrooms grown in small sheds or cellars; where larger areas are grown, overhead ventilators are usually preferred.

Material for the Beds

Much work has been done overseas, because of the difficulty of obtaining fresh horse manure, on the establishment of suitable formulas for making compost for growing mushrooms, but because of the difficulty of getting a sufficiently standardised product there seems for the home gardener in New Zealand no suitable substitute for horse manure. If fresh manure that is not rain soaked is used, and certain principles are followed, its behaviour is usually consistent and so predictable.

The manure should be clean and fresh; manure containing disinfectant or from horses under veterinary treatment should not be used, and the use of manure containing shavings, sawdust, or similar material is not advisable. The best type contains a good proportion of straw litter—up to 50 per cent. is satisfactory. Wheat or rye is usually preferred to oat or barley straw. The manure must be composted, that is, turned and mixed several times so that it heats and rots down gradually to the required even heat and texture. This mixing or turning should be done under cover and preferably on a concrete floor that has first been thoroughly cleaned and is situated where water will drain away from it; it should be well away from old rubbish heaps or material likely to harbour flies or other harmful insects.

The manure should first be tested for moisture content by squeezing handfuls from different parts of the heap. If the material binds together under pressure and only a trace of liquid is squeezed out, it is in suitable condition. If it is dry, it should be watered with a can having a fine rose until it is moist but not wet. This is important, because if it is made too wet, heating is retarded and it is often difficult to dry it out again sufficiently.

Thread-like mushroom mycelium often branches out through well-drained turf which has been manured by feeding stock. Where the mycelium has found a congenial environment groups of mushrooms often appear.

The manure should first be forked over, thoroughly mixed, and foreign matter removed. Finally, it should be made into a deep, compact heap so that fermentation can take place. It should not be compressed, but limited consolidation will not have any adverse effect if the manure is not too wet and aeration is satisfactory. If it is necessary, the heap should be watered during the first or second turning, for straw will absorb more water when fresh than it will after it has partly rotted. There should be enough moisture to allow fermentation to proceed through several turnings and yet leave the compost just moist at the final turning.

If the compost has been forked over and heaped, it should be left undisturbed until fermentation has passed its zenith; this usually takes from 5 to 10 days and its outward manifestation is a slight sinking of the heap. During fermentation the temperature in the heap may reach from 100 to 160 degrees F.

As soon as the sinking that indicates that microbial activity is slowing down occurs the heap should be turned again. The material should be thoroughly shaken out and mixed and the new heap made so that the outside of the old heap is on the inside of the new and vice versa. As turning proceeds some of the material within about a foot of the sides of the heap may have become dry and appear burnt, leaving a whitish ash. Material so affected should be thoroughly moistened and mixed throughout the heap. The compost should be tested for moisture content, and when turning is completed it should again be heaped compactly and left to ferment.

Turning should be continued at intervals of 4 to 10 days or whenever burning occurs. The number of turnings required before the composting process is complete may range from three to six and depends on the state of the material. Considerable judgment is required to decide what is the ideal condition, but when ready for making up into a bed the material should be warm, its colour should be a uniform blackish brown, and it should have a slightly greasy feel and a sweet odour suggestive of mushrooms. The straw should break or sheer off cleanly when twisted in the hands.

If a handful of compost is firmly squeezed, there should be sufficient moisture for it to bind but insufficient to wet the hand properly. There is too much moisture in the compost if, when a handful is held close to the ear and squeezed, the movement of the juice can be heard. Too much moisture will adversely affect the growth of the spawn and may kill it if aeration of the bed is affected. Some composts are made more productive by superphosphate at 1¼lb. per hundredweight, but superphosphate may depress yields on other composts.

Types of Beds

Mushroom beds may be either flat or ridged, or they may be made up on shelves or in boxes. Ridged beds are suitable for both inside and outside production. Boxes should be not less than 10in. deep and 2ft. long by 18in. wide. To facilitate picking, flat beds should not be too wide. Laid down in summer, they need not be more than 8in. deep, but under cool conditions or in cold frames it is better to use a depth of 10in.

Ridged beds have sloping sides and in cross section are usually in the form of a triangle or a trapezium. They can be of any length, but when built outdoors should not be closer than 3ft. 6in. between the ridges, because when they are finished they must be coated with about 1ft. of straw, which blocks up any narrower pathway. They should be about 2ft. 6in. wide at the base and 2ft. high, and the top, if flattened, should be about 6in. wide.

It is essential that the land on which mushroom beds are built should not at any time be wet and if necessary the beds should be built on planks raised above the ground or on a firm base of open material such as coke or shingle.

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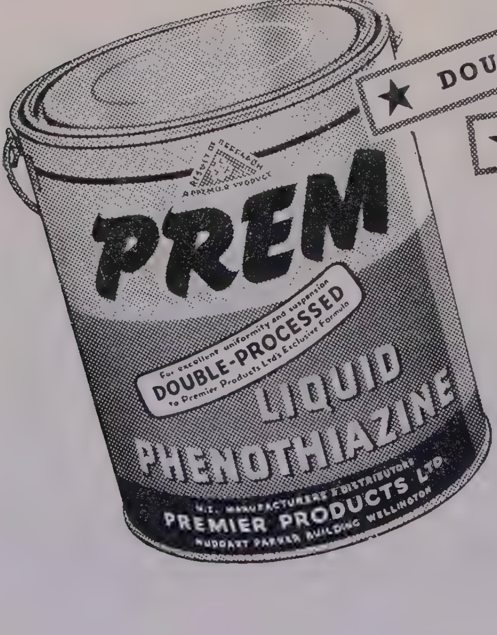

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The positions of outdoor beds should be changed each year. Before inside beds are laid down it is advisable to clean the floor and walls thoroughly, preferably with a 2 per cent. formalin solution. This should destroy the spores of any fungi which may be inimical to the growth of the mushrooms. Beds are made by forking the prepared compost evenly into position in layers and firming by beating it down with a fork or by treading on a short board placed on the compost. If the compost is not too wet, the firming may be done gently with the foot. A 9in. to 11in. layer would be reduced after firming to from 6in. to 8in.

If a cold frame is used, the walls should be of good heat-insulating material such as brick, concrete, or turf, and if there is no danger of flooding or seepage, more even temperatures can be maintained by excavating about 6in. of soil and building the bed partly below ground level. Frames can be ventilated in the usual way by chocking up the covering light during the day with a piece of wood. The sash or light, however, should be kept covered with suitable insulating material such as a combination of straw and sacking to keep temperatures even.

If boxes or trays are being used, it is advisable, unless they are to be stored in sufficiently damp conditions, to put 2in. of clean, fresh turfy soil in the bottom of each box to prevent drying out. The yield from boxes or trays is usually relatively low.

Spawning

After the beds have been laid they should be left for several days. Outside beds should be covered with straw to prevent excessive drying and to keep off rain. The temperature should rise again quickly and at this stage it is necessary to use a thermometer, preferably a plunge one. Internal temperatures of up to 140 degrees F. may be reached, and with ridge beds which have considerable bulk and where composting has not been correct it may be advisable if the temperature rises above this to make several holes in the bed to speed up cooling. This practice is not recommended except in extreme cases, for the holes must be refilled afterward with clean, fresh soil and this sometimes presents some difficulty; the soil introduced is often a potential source of infection with undesirable fungi.

If the beds become too hot internally, they may dry out excessively or become too wet near the surface because of condensation of internal and perhaps external moisture. This can usually be controlled to some extent by covering them with straw or by giving added ventilation. Beds do not always cool evenly, but if, after testing, the temperature is nowhere higher than 70 degrees F., spawning may be begun.

Instructions for spawning are given by the maker with each package of spawn and should be closely followed. The usual practice is to insert pieces of spawn about 10in. apart in a diagonal pattern all over the bed, each piece being placed a depth of from ½in. to 2in. (according to the maker's instructions). A little of the compost should be removed each time and the spawn covered so as to be in contact with the compost all round. When finished the beds should again be covered with straw.

Casing the Beds

If the temperature of the beds and air has been kept at about 58 degrees F. or higher, the spawn should begin to run within 8 to 14 days; at lower temperatures the delay is likely to be greater. If after the compost has been carefully exposed numerous strands of white cotton-like mycelium are seen developing in it, casing can begin. This is one of the most important operations in the growing of mushrooms. Any type of soil is not necessarily suitable. Ordinary surface soil from the garden, especially if it is rich in humus, usually contains bacteria, fungi, or insects which are likely to be a cause of trouble later.

If garden soil is used, it should be sterilised and poor in humus. Subsoil or soil from the second spit is usually sufficiently sterile. If it is lumpy, it should be rubbed through a ¼in. mesh sieve. A light, friable or sandy subsoil loam is probably ideal. Flat beds or boxes should be covered 1in. deep; ridged beds can be covered 2in. deep at the edges, thinning to 1in. at the top of the ridge. The soil, which should be moist but not wet, should be beaten gently and firmed evenly with the back of a spade. The soil reaction should be about neutral, or from pH 6 to pH 7.8. When the beds are cased the straw covering may be dispensed with except on outside beds.

Attention to Ventilation

The best mushrooms are usually grown at temperatures of 54 to 58 degrees F. and in an atmosphere that is damp but not excessively so. The air should be kept just moist enough to permit gradual evaporation from the beds. This can be achieved by attention to ventilation and if necessary by damping down the floor. If the casing dries out anywhere, it should be lightly watered with a fine spray, but only the casing should be watered.

During the first 6 to 8 weeks after the bed has been cased, which is the earliest that mushrooms can be expected under good conditions, watering with a fine rose may be necessary at weekly intervals. Salt at the

Left—A desirable type of wild mushroom growing on a rich turf. Right—Mushrooms growing on an abandoned lawn.

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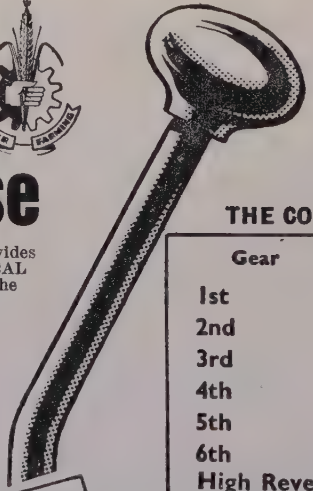

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5th	5.49	6.41	7.32
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rate of about 1 level tablespoon to 2 gallons of water applied at weekly intervals if the beds are dry is said to be beneficial when cropping has begun. Outside beds usually take 8 to 12 weeks or longer to come into bearing. The temperature usually determines the period taken.

Harvesting

Mushrooms first appear in small clusters over the points at which the spawn was planted and later they should cover the whole bed. They should be picked daily before the "cap" is fully expanded, by twisting each gently so that the whole mushroom with its stem is cleanly withdrawn. No rubbish should be allowed to fall on the bed and trimming is best done elsewhere. All dead or dying mushrooms or mushroom parts should be carefully removed. After a mushroom or group of mushrooms is picked the fleshy stump should be removed and the hole filled with fresh casing soil.

A bed usually lasts 2 to 4 months and the total yield over the period varies from 1lb. to 3lb. per square foot. For the home gardener 1lb. per square foot could be considered very satisfactory. Mushrooms usually appear in weekly flushes. At temperatures of 60 degrees F. and higher production is usually heavy, but lasts for only about 2 months; at such high temperatures the mushrooms usually grow too fast and quality is affected. At 50 degrees on the other hand, though production over a given period will be lighter, beds may continue to yield for 4 months or even considerably longer.

Insect Pests and Diseases

Millepedes, woodlice, springtails, mites, and the larvae of various flies and midges may be injurious to the mushroom at various stages of its development; a number of fungous diseases and more rarely physiological and bacterial diseases are liable to be troublesome.

Hygiene is the most important factor in combating both insect pests and diseases. Enclosed areas where mushrooms are to be grown should be thoroughly cleansed and sterilised by washing with a 2 per cent. formalin solution or fumigated by closing the place and burning flowers of sulphur (also known as ground or sublimed sulphur) at the rate of 3lb. to 500 cub. ft. of space. As turning proceeds care should be taken to include all odd scraps of manure in the heap so that they are subjected to the heat arising from fermentation. Odd scraps of manure left in corners or adhering to walls provide hatching grounds for the eggs of many species of insects which are easily killed if included in the fermenting heap.

During mixing of beds and before beds are cased pyrethrum or D.D.T. should be dusted lightly over them if insect pests are numerous. Pyrethrum or D.D.T. can also be applied after casing, though because of the danger of poisoning care should be taken to avoid getting D.D.T. on the growing mushrooms. All refuse should be destroyed and windows and ventilators should be covered with fine-mesh wire or coarse cheese cloth to exclude pests.

Photographs of mushrooms by Green and Hahn Photography Ltd.

[*R. W. Orr photo.*

Disease-free refuse should be composted. The compost bin is of brick and concrete and has movable front boards.

Work for June

GARDEN duties are usually restricted at this time of year owing to unfavourable conditions making working of the soil fairly difficult. However, there is much to be done and gardeners should take the opportunity to do the many small jobs that are normally left because there are more urgent ones.

Although winter crops should occupy a considerable portion of the garden, there will be vacant plots or plots in cover crops. These should be dug over if soil conditions permit and green crops dug in if at the right stage. Soil should not be worked if too wet, as this may damage its texture, making it more difficult to work later. As efficient drainage is important, gardeners with new gardens should check drainage during winter and make improvements thought necessary. Drainage can often be improved by breaking up the subsoil if it is impervious.

Winter Maintenance

Gardeners can use wet week-ends for doing many small jobs that tend to be neglected. A neat and tidy garden is a pleasure to work in and a half day spent in tidying up is well spent. Bricks, timber, heaps of rubbish, or sacks left about harbour slugs and snails and make the garden untidy; tools tossed into the corner of the shed and general shed untidiness do not make pleasant working conditions. All these can be rectified when conditions do not allow work outside.

Many gardeners do not find time in summer to give the required attention to garden tools, so opportunity should be taken now to clean them, make repairs where necessary, and sharpen them. A rub over with oil will help preserve them and prevent metal parts from going rusty.

Planning for Next Season

As winter is the time when trees and shrubs are planted, a review of the existing shelter about the garden should be made to see if improvements are advisable. In selecting a type of live shelter gardeners should consider rate and density of growth, eventual height, extent of root system, and ability to stand wet or dry conditions, frost, or wind. Efficient shelter can increase production, particularly where gardens are exposed to unfavourable prevailing winds.

The purchase now of next season's seeds (provided new stocks are available) will tend to prevent some lines of vegetables from being forgotten later in the year. Consideration of what seeds to buy obliges the gardener more or less to plan his garden. This can be an advantage, as a well-planned garden means crops maturing at the right time, the required amount sown or planted, and the growing of the most satisfactory varieties.

Spray materials, manures, labels, stakes, and other odds and ends can all be purchased now to save time later.

Sowings

Soils in most districts will be cold this month and sowings therefore will be restricted. A few vegetables can be sown, but attention should be paid to drainage, and raised beds may be an advantage, as they improve drainage and tend to be warmer than those on the flat. The following can be sown:—

Broad beans: If a sowing has not been made already, it should be made

[*R. W. Orr photo.*

Early seedlings are best raised under glass. This frame can be moved to follow the winter sun.

now if the crop is to be harvested in spring. The soil should be reasonably warm and not too wet if germination is to be good.

Lettuce: Early-spring crops can be started now by sowing seed in frames or boxes covered with glass, which should be in a warm corner of the garden. Early plants are best set out on raised beds. Imperial 615 and Winter Neapolitan are good varieties for sowing now.

Cabbages and cauliflowers: Summer cabbages such as Golden Acre, Copenhagen Market, and Henderson's Succession can be sown in raised beds in a warm corner. Seed should be sown thinly in rows to give sturdy and healthy plants. Varieties of cauliflowers to be sown the same way may include Phenomenal Early, Early London, and Walcheren.

Early crops: In very favourable localities in the North Island sowings of peas, radish, spring onions, turnips, and beetroot can also be made.

Plantings

Cabbages and cauliflowers of the varieties already mentioned can be set out, preferably on ridges to give good growing conditions.

Potatoes suitable for early crops, such as Arran Banner or Epicure, can be set out in very early localities. Planting should not be done if frosts are normally experienced at this time.

Herbs: For those favouring herbs June is a good month to add to the present collection. Planting of bush types like sage and thyme is normally done during winter, when growth is at its lowest ebb.

Other Tasks

New asparagus and rhubarb beds should be prepared now for planting a month or two later. Ever-bearing rhubarb ready for lifting should be split and replanted immediately, but summer types can be left under shelter until the crowns swell, when they can be split and replanted.

Stored vegetables should be sorted carefully and unsound ones discarded.

Seed potatoes can be set out in trays for greening with the rose ends (ends opposite the stalks) uppermost and the trays left in an airy shed for stout sprouts to develop. Orders for seed should be placed early to ensure delivery at the appropriate time, and gardeners should endeavour to get Certified seed.

Winter crops should be inspected for diseases and pests and sprays applied accordingly. Root crops may need to be lifted if rots develop through wet conditions.

Perennial weeds should be eliminated as garden plots become vacant.

Meteorological Records for March

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	201	64.0	+ 0.2	78.7	47.0	3.00	10	— 1.18	1.75	27	177.6
Auckland	160	66.0	+ 1.1	76.7	53.8	1.96	10	— 1.19	0.70	28	182.2
Tauranga	10	62.6	+ 0.0	78.9	43.2	1.02	5	— 3.08	0.44	28	209.8
Ruakura . ..	131	60.4	— 0.8	77.2	41.8	3.05	8	0.07	1.08	28	152.4
Rotorua ..	969	59.8	— 0.7	76.4	40.0	1.31	6	— 2.56	0.52	28	161.9
Gisborne	12	61.8	— 0.7	85.8	40.4	0.93	8	— 2.77	0.30	5	232.3
New Plymouth ..	160	61.3	+ 0.3	72.2	47.0	2.39	12	— 1.34	0.91	28	174.1
Napier . ..	5	63.2	+ 0.8	86.6	41.2	0.32	7	— 2.26	0.12	12	234.2
Karioi ..	2125	55.4	+ 0.3	75.0	37.0	2.71	10	+ 0.37	0.86	4	
Wanganui	72	62.3	+ 0.7	81.9	49.6	3.11	11	+ 0.96	0.81	4	179.8
Palmerston North .	110	61.1	+ 0.8	76.0	42.5	1.42	11	— 0.81	0.35	28	163.5
Waingawa ..	350	58.5	— 0.5	76.2	36.5	3.37	10	+ 1.17	1.43	12, 28	198.5
Wellington . ..	415	59.0	— 0.4	70.9	44.2	4.30	10	+ 1.12	1.66	12	189.4
Nelson	5	59.6	+ 1.2	75.8	39.0	3.14	8	+ 0.45	1.14	28	231.8
Blenheim . ..	12	59.2	— 1.2	80.9	36.4	2.34	10	+ 0.81	1.05	28	231.5
Hokitika . ..	12	55.6	— 0.7	66.1	40.4	6.47	18	— 2.47	1.54	26	157.6
Hanmer . ..	1225	55.6	— 0.6	78.6	35.0	4.51	11	+ 1.16	1.67	28	187.4
Christchurch ..	22	58.0	— 0.1	88.2	36.3	3.79	8	+ 1.85	1.21	27	169.0
Ashburton	323	58.0	+ 0.2	83.0	36.6	5.40	8	+ 3.20	1.47	28	167.6
Timaru	56	57.2	— 0.2	80.0	41.3	5.01	10	+ 2.88	1.05	27	153.1
Alexandra	520	57.0	— 0.6	83.0	37.0	1.94	9	+ 0.75	1.40	11	183.0
Taieri	80	54.8	— 0.4	86.5	35.3	3.29	13	+ 1.22	1.45	11	114.8
Invercargill ..	0	53.6	— 0.2	75.7	34.0	4.70	21	+ 0.67	1.00	11	132.2

Breeding Pigs with Better Performance

LARGELY because pig production in New Zealand is usually a sideline to dairying and is carried on with an inadequate labour force, this country has lagged behind many others in pig improvement. In this article A. Longwill, Superintendent, Pig Industry, Department of Agriculture, Wellington, discusses a scheme which is being promoted by the New Zealand Pig Producers' Council in co-operation with the Department of Agriculture.

["*Dairy Exporter*" photo.

Berkshire sow with first-cross litter by Tamworth boar. Cross-breeding is a well-established practice in New Zealand pig production. Its advantages in giving hybrid vigour to the first-cross offspring are to be exploited in the pig improvement scheme described in this article.

THE milestones of pig improvement in New Zealand are briefly:—

1. **Importations of pedigree pigs by individuals before the First World War:** With the development of the dairy industry pigs became recognised as a natural sideline to make use of otherwise-embarrassing dairy by-products. Although the market was still purely a local one, a number of far-sighted individuals as well as Government departments had imported registered stock from Great Britain and to a limited extent from Australia.

2. **Establishment of the New Zealand Pig Breeders' Association, which was registered under the Incorporated Societies' Act 1908 on 17 November 1916:** This was the first major step in the organisation of the pig industry and provided the first forum for those interested in the improvement of pigs. No New Zealand herd book existed and the editing committee for the first herd book had a formidable task.

3. **The first Herd Book of the New Zealand Pig Breeders' Association:** Published in 1918 this gave three-generation pedigrees for a total of 90 boars and 207 sows as follows:—

	Boars	Sows
Berkshires	70	172
Yorkshires	7	15
Tamworths	10	15
Large Blacks	3	5
Totals	90	207

It is notable that Berkshires largely predominated at this stage and that Yorkshires (Middle White) and Tamworths, which would be used in commercial crosses with the Berkshires, are breeds which would give early-maturing, porker-type carcasses. Probably this foundation helped to build the reputation for good, meaty porkers when the export trade was started.

4. **With the establishment of the New Zealand Meat Producers Board in 1921-22 the foundation was laid for more orderly export marketing:** From an insignificant quantity at first—there was an average of less than 25,000 carcasses exported in the first 3 years of operation of the board—exports were gradually built up. During the depression of 1932-35 both production and exports expanded rapidly, reaching a peak in 1935-36 under the stimulus of necessity brought about by the low price for butterfat.

The interest in the pig industry which had been revived in the 1920s, when more efficient marketing methods were being introduced led to the demand for scientific investigation of some of the industry's problems. Pioneer work on pig feeding in New Zealand was being carried out by M. J. Scott at Canterbury Agricultural College and the Government was persuaded to promote investigations through the Department of Scientific and Industrial Research.

These investigations covered pig recording, aimed at establishing the best management practices, pig feeding trials, methods of bacon curing, and a survey of the industry aimed at defining the potential production and markets for New Zealand pig meats.

5. **Pig recording clubs:** Three groups were started in Canterbury, Manawatu, and Waikato in 1928. The importance of this movement as it affected pig improvement was that it set standards of performance both for litters and growth-rate of fattening pigs which could be applied by the individual breeder of pedigree pigs on his own farm and directed his attention to management methods which would allow the better stock to show their superior productivity. This provided a fund of information on which advice to farmers in pig husbandry could be based and gave rise to the demand for a national advisory service. This was set up in 1936 with the National Pig Industry Council as the policy-making body.

6. **Grading of pigs for export was a very live topic in the early years of the national council and standards of measurements were incorporated into Grading Regulations under the Meat Act in 1940:** Although the standards permitted approximately 75 to 80 per cent. of the total baconers to grade out in the top grade and therefore did not directly provide a premium for the better-than-average carcass, the worst pigs were penalised. This gave an incentive for the commercial producer to select a purebred boar, particularly if the breeder could prove by carcass results of pigs from the same strain that the boar's chances of siring pigs which would have good carcass quality were better than average.

The commercial producer was learning that it was profitable to secure breeding stock which were capable of

Purebred Berkshire sow with litter by purebred Large White boar. Such a crossing does not result in larger numbers of piglets born, but vigour of pigs is usually increased, resulting in more pigs reared.

performing well both in litter size and fattening efficiency, including carcass quality. Management on a reasonable number of farms had reached a sufficiently high standard to exploit fully more-productive stock if these could be obtained. Thus the stage was set for the establishment of a pig-improvement scheme on a national basis. The writer presented a paper on the subject at the conference of the New Zealand Animal Production Society in February 1951 to initiate discussion. The paper was further debated by district pig councils. The recommendations of J. J. Hancock, Chief Geneticist at the Department of Agriculture's Ruakura Animal Research Station, who had returned from an overseas visit during which he had studied the trend of thought in the application of genetics to practical animal breeding problems, were incorporated in a pig-improvement policy drafted by a committee of the Waikato District Pig Council.

With minor amendments this policy has been adopted by the New Zealand Pig Producers' Council. Basically this policy accepts the principle that extension work in pig husbandry to be fully effective must be associated with the work of pig improvement, so that as management standards are improved there are available stock with the productive efficiency necessary to exploit fully the advantages of better piggery conditions and management.

Part of the policy, therefore, is a breeding scheme, and the general outlines of this scheme, described by D. M. Smith, Research Officer, Ruakura Animal Research Station, were approved by a combined meeting representative of the Pig Producers' Council, Pig Breeders' Association, and the technical officers of the industry on 5 December 1952.

The points underlying the scheme put forward are:—

1. The sow population in New Zealand is being renewed at the rate of 20,000 to 25,000 sows annually.

2. The number of purebred pigs registered in 1951 was only 2000.

3. Though the sale of unregistered purebred stock may be substantial, 66 per cent. of the sows in the industry in 1950 were crossbreds. Most of the boars in use are purebred, but are unregistered. Selection of boars on progeny test to improve the pure breed is therefore hampered.

4. The proportion of crossbred pigs has remained unchanged since 1928, when, as in 1950, 82 per cent. of all pigs on farms were non-purebred.

5. The present output potential of purebred stock is not adequate to provide more than a nucleus for the further production of crossbreds and the maintenance of existing studs.

6. The main problem as defined by the losses survey in 1949-51 is small litters at birth. The use of purebreds in the commercial field would probably not result in any improvement in productivity. The 1949-51 survey showed that 1178 litters from purebred sows by purebred boars averaged 8.9 pigs born per litter; the average for all litters in the survey was 9 pigs per litter. There are two methods:—

(a) By use of a prolific purebred.
(b) By cross-breeding (a prolific breed being used as one of the parents) and breeding commercial stock from the crossbred female progeny.

The Large White is New Zealand's most prolific breed (average 9.6 pigs born in above survey), but it is safe to state that as purebreds they are not acceptable to all New Zealand farmers. The use of the Large White as the sire or dam of crossbred sows, however, will in general have the effect of:—

(a) Providing females with above-average prolificacy.

(b) Increasing the vitality of litters to the extent that pre-weaning losses are reduced. (This increase in vitality is a direct result of crossing and is not due to the use of any particular breed.)

(c) Providing sows capable of withstanding the rigours of New Zealand pig-keeping conditions.

Suggested Plan

The first aim of the scheme is to increase the number of pigs reared per litter.

The breeding method suggested as likely to be most effective is that of reciprocal recurrent crossing. This should be carried out at a properly set up breeding centre. The scheme is briefly:—

1. Boars of breed A are mated to sows of breed B. Boars of breed B are mated to sows of breed A.

2. The first-cross sows are mated and used to produce fattening pigs.

3. The parents of the most successful progeny—for example, sows of breed A which have successfully mated to boars of breed B—are then mated to boars of their own breed. These boars are those which have sired successful progeny when mated to sows of another breed.

4. The purebred progeny of the within-breed matings are:—

(a) Used for further testing.
(b) Sold to stud breeders.
(c) Sold to multipliers.

5. The crossbred progeny of the test crosses are sold to farmers and the district pig council supervisors then:—

(a) See that these animals are properly fed and housed.
(b) Record the litter performance and report back to the breeding centre.

6. The multipliers will be farmers:—

(a) With good layouts.
(b) Willing to co-operate and record.
(c) Willing to act as demonstration centres for districts.

7. These multipliers will sell crossbred progeny to farmers.

Progress to Date

Since the general principles of the breeding scheme were approved the executive of the Pig Producers' Council has come to an agreement with the Department of Agriculture whereby the Department undertakes to run the breeding centre for 5 years, during which the scheme can be regarded as going through the experimental stages.

The council has undertaken the responsibility for finding the capital for extra buildings required for the breeding centre on Ruakura property, to cover the wages of one technician employed at the centre, and to provide a house if required.

A Breeding Centre Advisory Committee of 8 members has been set up comprising the executive committee of the Pig Producers' Council, a representative of the Pig Breeders' Association, the Superintendent and Pig Research Officer, Ruakura Animal Research Station, and the Superintendent, Pig Industry, Department of Agriculture.

On the recommendations of this committee the necessary housing developments are proceeding and soon the breeding centre will be ready to accept stock for testing. It has been decided that in the initial stages it will be possible to work with two breeds only at Ruakura, the Large White to be one of them. The other breed will be determined on the basis of standards of performance of the pigs offered by breeders for the initial stock of the centre.

Selection Standards

A small committee will complete the selection of the sows and boars, but prior recording of performance will be necessary to enable the committee to choose the most suitable stock. An indication of the type of information looked for and the minimum standards of performance required is given by the following, which is a draft of the minimum requirements being considered by the committee, but which may be amended or expanded in the light of experience:—

1. Stock must be registered pedigrees.

2. Females should have farrowed two and not more than four litters.

3. The average number born in the first two litters should be not less than 11.

4. The average number weaned over these two (or more) litters should be not less than nine.

5. The average weaning weight should be at least 36lb. for the first litter and 40lb. for any subsequent one.

6. The records of parents and where available grandparents should also reach the above standards.

7. Where carcass records are available the minimum average for pigs is to be 70 per cent. as laid down in the national judging standards.

8. It will be regarded as an advantage if records are available of the results of cross-breeding with animals submitted.

9. The animal, whether boar or sow, must be free from defects such as uneven toes, bad teating, and other obvious defects of commercial importance.

10. Boars should be selected on the performance of their progeny:—

(a) Standards of litter size of daughters to be as indicated above.

(b) Growth rate of progeny:—

	From first litters lb.	From second and subsequent litters lb.
8 weeks ..	36	40
16 weeks ..	90	100
26 weeks ..	180	200

(c) Carcass-quality score to average not less than 70 per cent. based on national judging standards.

It is hoped through the scheme to:—

1. Maintain supplies of reliable breeding stock for farmers in the form of first-cross sows and purebred boars from proven strains.

A pedigree Large White boar. This breed has higher prolificacy than any other breed in New Zealand and is therefore favoured for selection as one of the breeds to be used in the crossing system.

2. Increase the degree of uniformity of type in the pigs and therefore the carcasses which are produced.

The success achieved will depend on being able to find the best strains of pedigree pigs in the country.

The scheme will provide breeders with an opportunity to test under standard conditions their best strains against those of other breeders and thus give a performance basis to their selection of the breeding stock for further stud use.

As a first step breeders should make sure that they have the type of information already outlined at least on the best strains represented in their breeding herds. This can be ensured by having sows recorded under the official pedigree sow recording scheme.

The following are the rules under which the scheme operates:—

1. The breeder shall offer for test only such sows as are registered in the Herd Book of the New Zealand Pig Breeders' Association and in farrow to a registered purebred boar of any breed.

2. For each sow being offered for test the breeder shall complete and dispatch the two forms (obtainable from all offices of the Department of Agriculture) as follows:—

One to the Department of Agriculture, Box 2298, Wellington, together with the fee of 5s.

One to the New Zealand Pig Breeders' Association, Box 148, Palmerston North.

These forms are to be dispatched simultaneously, not later than 3 weeks before expected date of farrowing.

3. The Department may refuse nominations not received within the dates specified.

4. The testing fee of 5s. for each sow placed under test shall be payable and due at time of nomination.

(a) Nominations shall not be accepted unless accompanied by testing fees.

(b) Payment may be made by cheque (to which exchange must be added), by postal note or money order or by public account bank receipt, Bank of New Zealand.

(c) If the sow fails to farrow or dies or if there are less than four of the litter alive at 3 weeks after farrowing, the nomination fee will be held in credit, provided that no weighings have been made by the Livestock Instructor. Such credits must be utilised within 1 year from the date on the Department's receipt for the fee.

When a sow has farrowed the breeder shall notify the Livestock Instructor at the nearest office of the Department of Agriculture within 1 week of the farrowing and keep him informed of anything happening to the sow or litter that makes it unnecessary to weigh it.

6. The breeder shall provide reasonable facilities for the Livestock Instructor for the work of recording, including: (a) Approved means of holding the pigs, that is, a safe holding pen in which the pigs are to be held ready for weighing. (b) Assistance by the breeder in carrying out field work, such as catching the pig.

7. The breeder shall employ the system of identification by ear-marking adopted by the Pig Breeders' Association and the Department of Agriculture.

8. As may be required by the Department of Agriculture the breeder shall supply certified details of the sow, her feeding and management, and her litter.

9. The breeder shall observe the rules of the Department of Agriculture and accept without reserve any decision of the Department on the work of recording.

10. The Livestock Instructor or other authorised person of the Department of Agriculture shall weigh and record the litters of all sows under test, first when 21 days old or approximately 21 days old, and again when 56 days old or approximately 56 days old. At the first weighing only the total weight of the litter shall be recorded, and at the second weighing the weight of individual pigs shall be recorded. All weights so determined shall be adjusted when necessary, by proportion, to 21 days and 56 days respectively and shall not take account of the birth weight of the piglets. Thus, if a litter 108lb. at 18 days, weight at 21 days

$$= 108 \times \frac{21}{18} = 126\text{lb.}$$

11. At the first weighing the breeder shall permanently identify the sow under test, and each pig of the litter, consecutively, with suitable marks in the ear, in accordance with the ear-marking system adopted. The right ears of all pigs in the litter should have a similar litter mark and the left ear should have the individual mark.

12. The secretary of the New Zealand Pig Breeders' Association shall keep a register of all sows which have been accepted for test. This register shall contain all details recorded by the Department of Agriculture and shall be available for inspection at a fee and in a manner to be agreed on jointly by the New Zealand Pig Breeders' Association and the Department of Agriculture.

13. The Department of Agriculture may refuse to issue a statement of record in respect of any sow or sows placed under test. The decision of the Department of Agriculture in regard to such refusal shall be final and shall not be subject to appeal and need not be accompanied by any statement of the reason governing the decision.

14. The Department of Agriculture reserves the right to discontinue, without refund of testing fee, the test at any time of the sows of any breeder who does not conform to the rules.

15. The acceptance of a sow nomination does not bind the Department of Agriculture to continue and complete the sow recording in the event of a change of ownership during the recording period. The Department, however, will make every effort to complete the recording, provided it is notified within 1 week of the date of sale of the name and address of the purchaser and provided that the new owner agrees to comply with the rules of official pig recording.

16. The interpretation by the Department of Agriculture of the foregoing rules shall be final.

To follow up this litter recording, which of course should cover a series of litters from each sow and not merely one litter per sow, there are already schemes for providing the information needed by breeders to compete for selection of their stock for the breeding centre. These are:—

The performance record scheme for pedigree pigs, under which the breeder may send in not less than two or not more than four pigs to the works for full carcass appraisal.

Carcass quality scheme, which caters for lines of purebred or crossbred pigs, but for which there is a less exhaustive carcass appraisal.

The many carcass competitions judged under national rules. If pigs entered in such competitions are from recorded litters, the information obtained will be most valuable.

The development of a national pig improvement scheme can be an immense help in the improvement of pigs in New Zealand. It can perform its function efficiently, however, only if it is supported by all breeders. By co-operating in this effort they will be helping the industry on to a sound basis of efficiency, which is obviously of importance to its long-term economic soundness. In this way they will be accepting the responsibilities inseparable from the position of leadership in pig improvement which breeders hold.

Fodder Beet for Feeding Pigs

In the article on fodder beet for feeding to pigs on page 219 of the March issue of the "Journal" it was stated that Pajbjerg Rex X was the only variety that had so far been grown in New Zealand. This was incorrect, as other varieties have been grown, but according to overseas information the Pajbjerg Rex X variety has a higher dry-matter content than any of the others and for this reason is very suitable for pig feeding.

Care of Livestock during June

Contributed by the Animal Research Division

WINTER FEEDING OF DAIRY COWS

EXPERIMENTS have shown that cows fed well during winter will produce from 26 to 63lb. more butterfat in the following lactation than those which have been poorly fed during winter. These results were obtained when both groups were well fed after calving. It is therefore very important to feed the cows well from now until calving so that they have ample body reserves to draw on during the first 2 months of the lactation. It is difficult to build up these body reserves with even liberal amounts of hay and/or silage unless some grass is also available throughout the dry period. With a portion of the farm closed up for autumn-saved pasture for feeding after calving it is particularly important to graze the rest of the farm under a controlled rotational grazing system with adequate spelling between grazings, both to ensure continued grass growth during winter and to ration what grass is available throughout this period. Where subdivision is inadequate for this purpose break grazing with the electric fence is essential. Since cows will eat grass in preference to most other feeds, they should be fed as much hay as they will clean up in addition to 20lb. of silage per cow per day.

LIVER FLUKE IN SHEEP

In areas where sheep become infested with liver fluke flocks should be drenched now. The only effective drug is carbon tetrachloride, which should be mixed with 4 times its volume of liquid paraffin. The dose of the mixture is 5 c.c. for sheep of all ages, and 1 gallon is enough for about 900 sheep. Further information about liver fluke in sheep and cattle will be found in Bulletin No. 248, which is available from the nearest office of the Department of Agriculture.

WORMS IN LAMBS AND CALVES

Worms are sometimes still troublesome in May and June, and if lambs or calves are not doing well, they should be drenched with phenothiazine at the full dosage rates recommended by the manufacturers. Further information about worms and drenching will be found in Bulletins No. 171 and No. 189, which are obtainable from the nearest office of the Department.

LICE ON POULTRY

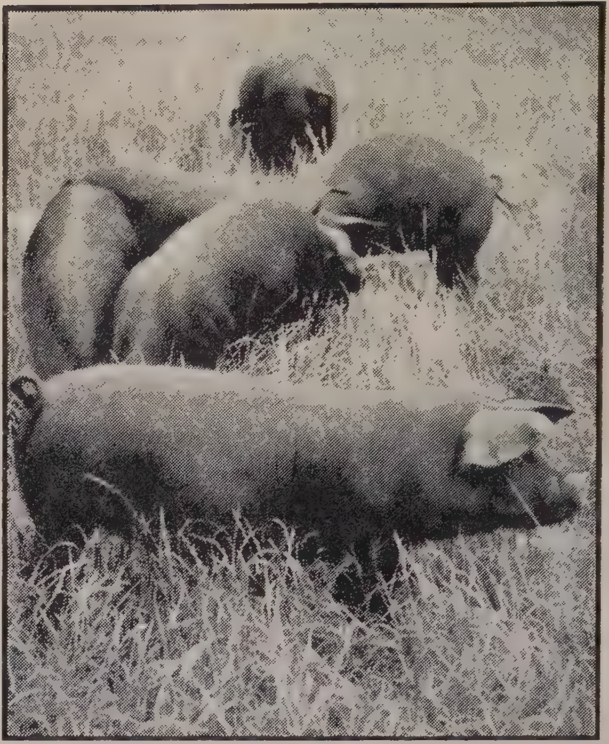
Poultry lice can cause considerable loss of condition in birds and reduced egg laying. To control these parasites a fine trickle of 40 per cent. nicotine sulphate should be run along the perches on a calm night before the birds go to roost. Two or three treatments should be given at weekly intervals.

RICKETS IN LAMBS

Lambs in Canterbury and some other South Island districts frequently suffer from rickets when wintered on green oats or barley and occasionally this trouble is experienced on other types of greenfeed. It can be prevented by giving one dose of vitamin D at the beginning of winter. The best preparation is Calciferol and the dose is 25 mg. dissolved in the smallest amount of olive oil which can be given conveniently with the drenching apparatus available. Even when rickets does not occur, this treatment induces much better growth in lambs during winter.

PIG PRODUCTION

Sows and store pigs should be fed on roots, grass, and up to 1lb. of meat meal or other high protein feed daily. Grazing pigs should not be confined to small paddocks during winter. The use of large grazing areas will reduce pasture damage considerably. Warm accommodation is essential for winter store pigs in order to avoid losses and maintain steady growth. Early-farrowing sows should be put in their farrowing quarters and fed 3 to 4lb. of meal daily. After farrowing they should be fed 4 gallons of milk plus 2/3 gallon for each piglet suckled. Where insufficient milk is available meal should be used to replace the milk in the ratio of 1lb. of meal to 1 gallon of milk. Constipation, which is common in late pregnancy, can be avoided by feeding ½lb. of bran daily or 4oz. of molasses 2 or 3 times during the last 10 days before farrowing.



Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during March and for the 8 months ended 31 March 1953, with comparative figures for the same month and 8-monthly period of 1951-52, have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:—

BUTTER

		Tons		Percentage
Period	Creamery	Whey	Total	inc. or dec.
March 1953	14,082	316	14,398	—
March 1952	14,025	224	14,249	—
Increase or decrease ..	+57	+92	+149	+1.045
8 months ended 31/3/53	147,056	2,734	149,790	—
8 months ended 31/3/52	142,564	2,335	144,899	—
Increase or decrease ..	+4,492	+399	+4,891	+3.375

Butter in store at 31 March 1953 was 26,918 tons

CHEESE

		Tons		Percentage
Period	White	Coloured	Total	inc. or dec.
March 1953	10,838	25	10,836	—
March 1952	8,614	51	8,665	—
Increase or decrease ..	+2,224	—26	+2,198	+25.366
8 months ended 31/3/53	88,099	134	88,233	—
8 months ended 31/3/52	79,073	570	79,643	—
Increase or decrease ..	+9,026	—436	+8,590	+10.785

Cheese in store at 31 March 1953 was 21,409 tons

If these figures are converted into butterfat equivalent, there is an increase of 4.844 per cent. in butterfat graded for the 8 months as compared with the corresponding period of the preceding season. The above figures refer only to butter and cheese graded for export, and owing to diversions which may take place from time to time, they are not necessarily a true indication of production trends.

Wheat Production; Feeding of Young Stock

Seasonal Notes by the Extension Division

WHEAT production has fallen far short of domestic requirements in recent years and the area sown annually could be substantially increased with advantage both to producers and to the general economy of the Dominion. In arable districts rotational systems should be designed to provide a rapid build-up in fertility while the land is in pasture and the exploitation of the stored fertility through cash crops. Last month's seasonal notes outlined suitable rotations for medium Canterbury land and detailed the place wheat should take in the cropping system. The area under wheat should also be increased in the wheat-growing districts of the North Island, particularly where pasture renewal has become necessary through continued over-grazing of pastures in winter.

SEED-BED FOR WHEAT

THE bulk of the wheat crop is sown in May and June, but in the North Island, southern parts of Otago, and Southland August and September are the main sowing months. It is preferable for autumn sowings to follow a summer fallow. This is particularly so in the drier areas such as North Otago and the lighter plains land in Canterbury to conserve moisture, on heavier ridge country for the destruction of twitch grasses, and for obtaining a suitable seed-bed where wheat follows old pasture. Autumn-sown wheat requires a firm seed-bed on land worked to a fair depth and with a rubbly surface which will not compact with winter rain. Winter rains and frosts will break this surface down, but it should remain rubbly until the wheat has given a complete ground cover in spring. Where wheat is grown after potatoes, rape, or peas too much cultivation can destroy the rubbly nature of the seed-bed. Where wheat follows old grass some form of surface working, either skim ploughing or pre-working with grubber and discs, is recommended. Breaking up the old turf and mixing it with soil allow the turf to decay before it is ploughed under.

SEEDING RATES AND FERTILISER

On the medium and good wheat land of Canterbury and North Otago the seeding rate for autumn wheat usually varies between 1½ and 2 bushels per acre. The heavier seedings are used where the rainfall is higher or on the heavy land where the large-grained variety Dreadnought is grown. On the lighter and drier soils seeding rates seldom exceed 1¼ to 1½ bushels and varieties are mainly smaller-grained wheats such as Cross 7 and Fife Tuscan. The seedings for spring-sown wheat are usually heavier and vary from 2 to 3 bushels per acre. Most wheat used for seed is dusted with one of the organic mercurial dusts for the control of stinking smut. A standard application of 1cwt. of superphosphate compound is generally recommended for the wheat crop.

—W. R. LOBB

* * *

WINTERING OF YOUNG STOCK

THEIR first winter is a critical period for calves and hoggets and the main essential in successful wintering is for the young animals to enter the winter in good condition. During the preceding late spring, summer, and autumn dairy calves should be rotated ahead of the dairy cows and hay feeding should start in the autumn before grass growth ceases. Calves should be accustomed to being fed hay and silage before they have to rely on these fodders for the main part of their daily ration. During the winter the young dairy stock should be kept separate from the main herd so that they will receive their full ration of supplementary feed without hindrance from older animals.

The basis of correct hogget wintering is an adequate supply of essential nutrients, a careful watch on thriftiness, and, if necessary, drenching at correct intervals for the control of internal parasites. In regions where crops for supplementary winter feeding are not required hoggets are generally wintered on specially selected areas. To provide the best conditions for wintering these hill-country hogget blocks require to have a well-sheltered, northerly aspect with an ample supply of clean water. In addition the pasture should be of good quality, clean, and kept at the correct stage of growth by using cattle. The addition of good-quality hay to the winter ration is beneficial. During routine shepherding any hoggets which do not thrive should be removed to a smaller paddock having short, high-quality pasture and a course of drenches should be given. Where conditions require the provision of winter supplements the area grown in roots is usually in proportion to the length and severity of the winter and the amount of food provided by the run-off. Hoggets are given first grazing off a crop and should be fed in breaks, care being exercised to avoid overcrowding through making breaks too small. Suitable grass run-off should be provided as well as feeders for chaff and hay.

—R. B. GORDON

* * *

DRAIN TILE SIZES

IN planning a drainage system it is necessary to decide on the size of tile to be used and, if more than one size is required, the number of each size that will be needed. Usually this will mean choosing 3in., 4in., or 6in. tiles. It is possible to obtain tiles larger than these, but their use is very limited because of their high cost.

The main deciding factor will be the amount of water to be carried by the tile. The capacity of the tile is determined first by its diameter and secondly by the fall available, as this will affect the velocity of the water. It is important to remember that the difference in capacity between two sizes is roughly in proportion to the difference between their cross-sectional areas, not their diameters (reduced frictional loss in the larger tile sizes accounts for a further increase in capacity). This means that under similar conditions and allowing for both increased size and reduced friction a 6in. tile will carry more than 4 times as much as a 3in. tile.

TABLE 1—MAXIMUM AREA TO BE DRAINED INTO TILES OF VARIOUS SIZES ON VARIOUS GRADES ON CLAY SOILS

	Fall			
Size of tile (inches)	1 : 500 (acres)	1 : 300 (acres)	1 : 200 (acres)	1 : 100 (acres)
3	2/3	¾	1	1½
4	1½	1½ to 2	2 to 2½	2½ to 3
6	4 to 4½	5	5 to 7	7 to 10

TABLE 2—MAXIMUM AREA TO BE DRAINED INTO TILES OF VARIOUS SIZES ON VARIOUS GRADES ON COARSE-TEXTURED SOILS

	Fall			
Size of tile (inches)	1 : 500 (acres)	1 : 300 (acres)	1 : 200 (acres)	1 : 100 (acres)
3	1½ to 2	2 to 2½	2½ to 3	3 to 4
4	4	5	5 to 7	7 to 10
6	10 to 12	15 to 17	17 to 20	20 to 30

These tables are taken from Massey Agricultural College Bulletin No. 18.

In practice it is considered advisable for economic reasons to load the larger tiles to an even greater extent than in the above tables. Though 3in. tiles are perfectly satisfactory under suitable conditions, usually the small difference between their price and that of 4in. tiles and the fact that the 4in. tile will carry nearly twice as much water causes many farmers to use nothing smaller than 4in. tiles.

—D. F. SCOTT

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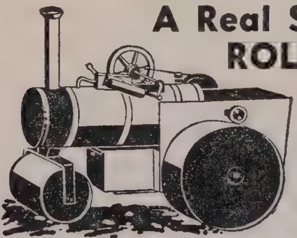

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Management and Costs of Household Poultry Flock

THE conversion of a poor-type laying shed into one having the essential characteristics of an efficiently constructed house for 50 pullets was described in the April issue of the "Journal" by S. G. Haddon, Poultry Instructor, Department of Agriculture, Auckland. In this article he gives a detailed description of the management of the pullets put in this reconstructed laying shed, with details of the cost of maintaining the flock and the returns in eggs received. The article will be of interest to household poultry keepers, as it describes the practical problems with which they may be faced, and also gives details of the expenditure to be expected when a small flock of laying birds is being run.

First-cross pullets from Australorp cockerels mated to White Leghorn hens are suitable for the household poultry keeper. A breeding pen that will produce this cross is shown above.

FIFTY perching pullets hatched on 27 September 1951 were bought on 15 December 1951 at approximately 10 weeks of age at a cost of 10s. each and were immedately managed intensively in the house described on ad lib. dry mash and free-choice meat meal. The first sack of mash was No. 2 standard chick mash and all subsequent sacks were No. 1 standard laying mash. After 3 or 4 weeks the birds were worked on to a system of feeding where all food, including grain, was fed in troughs and no scratch feed was given in the litter. By this system more grain than mash was consumed, but the free-choice meat meal allowed the birds to balance their own protein requirements. All food had the correct amount of vitamin A fish oil added each time the troughs were replenished (about every 4 days). No special efforts were made to provide green food, but while a bed of spinach beet lasted the pullets had a small amount of green food daily. Yolk colour would have been improved, however, if green food had been fed consistently throughout the year. The quantity of food consumed by the birds was noted, and the total cost of food, litter, and cartage recorded from the date of purchase of the pullets to the date of first egg was £11 9s. 9d., or 4s. 7d. per bird, based on a figure of 50 birds.

[*Fraser Niederer photo.*

Shade in the outside run during hot summer weather is an advantage. Outside runs are not essential, however, if floor space in the laying house is ample.

Mortality in Growing Period

An important point is stressed here. During this growing period six pullets failed to grow in spite of repeated deworming with carbon tetrachloride capsules. These six were destroyed before the others came into lay, but their purchase and rearing costs have to be loaded on to the remaining 44 pullets. This means in effect that £3 (purchase price) plus £1 7s. 6d. (food costs), a total of £4 7s. 6d. extra, has to be carried by the remaining 44 pullets; that is, the 44 pullets on point of lay cost 16s. 7d. each instead of 14s. 7d., an increase of 14 per cent. in the final rearing cost. If these figures are applied to a pullet flock totalling hundreds, the importance of mortality during the growing period becomes obvious. This mortality of 12 per cent. was much higher than should be expected with birds from first-class breeding stock, but it probably reflects the figure for the general run of commercial flocks.

Two of the cull pullets developed vent gleet. This raises the question how such a disease could occur in a closed pullet flock. Furthermore, the condition was completely cured in one bird and considerably alleviated in the other by the lesions being dressed 2 or 3 times with neat feeding oil. This experience lends strength to a recently expressed opinion that vent gleet is not a venereal disease of poultry, but can be an infection of damaged tissue caused, for example, by vent pecking or cannibalism. The birds concerned were, however, valueless culls.

The history of the 44 laying pullets shows this early high mortality rate continuing in adult life. In the first

RECORD OF EGG PRODUCTION 1952-53
(for a hen-housed flock of 44 birds)

4-weekly period beginning 1 March	Eggs laid per period	Total eggs laid	Hen-housed average per bird per period	Average percentage for flock
1952				
March	316	316	7.2	25.4
March-April	720	1036	16.4	58.4
April-May	795	1831	18.1	64.5
May-June	642	2473	14.6	52.2
June-July	650	3123	14.8	52.7
July-August	743	3866	16.8	60.3
August-September ..	773	4639	17.6	62.7
September-October ..	746	5385	16.9	60.6
October-November ..	743	6128	16.8	60.2
November-December ..	657	6785	14.9	53.4
December-January ..	624	7409	14.2	50.6
1953				
January	579	7988	13.2	47.0
February	520	8508	11.8	42.2

3 months one bird died of visceral gout and 3 wasted away and were killed. Post-mortem examination indicated leucosis. In the second 3 months one bird died of internal hemorrhage and in the next 6 months a persistently broody bird was killed for the table. Thus it will be seen that in spite of a hen-housed number of 44, the flock was actually 41 layers for most of the season. However, all laying costs are based on a figure of 44 birds.

Costs and Receipts

The financial side is interesting. The total cost to date of first egg is made up as follows:—

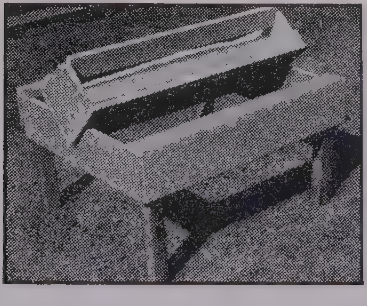
	£	s.	d.
Purchase price	25	0	0
Food (820lb.), litter, cartage, etc.	11	9	9
Total rearing cost	36	9	9

This means that the cost per pullet to the end of February (5 months of age) when production started was 16s. 7d., of which 10s. was the purchase cost and 6s. 7d. was the food and litter cost.

The amount of food consumed was a total of 820lb.

Apart from eggs used in the house and a very few sold to a local consumer, all eggs were sold through an egg floor.

On 4 August 1952 (nearly 8 months after purchase at 10 weeks of age), the flock had cost in purchase price, food, a small cartage bill, straw, and other items a total of £57 11s. 6d. and had returned by sale of eggs through an egg floor £57 19s. 5d.



The type of dry mash hopper used for the small flock of layers described in this article.

From that point all excess of egg receipts over food and cartage costs was gross profit, and in addition the birds had a final sale value. In practice this sale value would help to offset the purchase of the original pullets or the replacements.

Eggs through the floor at that date totalled 260 dozen for a total receipt of £57 19s. 5d. or an average of just over 4s. 5d. per dozen. Over the 12 months a total of 8508 eggs were laid at a value of £125 4s. 10d. or 3s. 6d. per dozen.

The cost of food, litter, cartage, and miscellaneous items during the 12 months of lay amounted to £63 14s. 7d. With the total rearing cost of £36 9s. 9d. added the total production cost of the 8508 eggs was £100 4s. 4d. or 2s. 9½d. per dozen eggs. This figure does not include any cost of labour.

Minimum Attention Given

Deliberately the flock was given the minimum amount of reasonable care to find out exactly what birds could do if they were given adequate housing and sufficient trough space and were not kept short of food or protein. On this basis the results must be regarded as satisfactory. Possibly more attention to the birds could have resulted in higher egg production, but only at the expense of greater labour and food costs. The final picture is summarised here.

	£	s.	d.	£	s.	d.
Purchase price 50 pullets	25	0	0			
Total costs food, litter, cartage, etc. ..	75	4	4			
				100	4	4
Sale of eggs (8508) ..	125	4	10			
Sale of cull hens at end of first laying year ..	22	17	6			
				148	2	4
Excess receipts over expenditure				47	18	0*

* Or 19s. 2d. per bird, calculated on the 50 pullets purchased originally.

Most Satisfactory Results

The flock laid in 12 months a total of 8508 eggs. On the hen-housed figure of 44 birds this gives an average production of 193.3 eggs per bird for the year. As the actual flock number was considerably less than 44 (41) for most of the season, this means that most of the birds must have laid well over 200 eggs each for the year, a most satisfactory figure when it is considered that the flock received no special treatment.

The table at the top of this page shows that once production got well under way (over 25 per cent. by the end of March 1952) the flock laid consistently well all through the autumn, winter, and spring and even in the twelfth month of lay egg production was over 42 per cent. This challenges the belief that complicated feeding routines and wet mashes are essential for satisfactory egg production.

◆

Ruakura Farmers' Conference Week

FARMERS from all parts of New Zealand will again have the opportunity to meet and discuss with agricultural scientists their own particular problems at the annual Ruakura Farmers' Conference Week, which is to be held at Hamilton this year from Tuesday 16 June to Friday 19 June inclusive in co-operation with the Waikato Farmers' Educational Committee. The chairman of the conference will be C. P. McMeekan, Superintendent of the Department of Agriculture Animal Research Station, Ruakura.

The well-planned programme deals specifically as it has done at the four previous meetings with problems of sheep and dairy farmers, and a large part of the time will be devoted to a section for all farmers.

The opening day, Tuesday 16 June, is set aside for the sheep farming section, and after the conference is opened will comprise papers on Ruakura's hill-country research programme, rickets in sheep, age marking of sheep, management of the fat lamb flock, rotational grazing of ewes and lambs, and the beef industry.

A field day at Ruakura and a question and answer panel will be held to open the section for all farmers on Wednesday 17 June. This section will extend to Thursday, when addresses will be given on molybdenum and its use in grassland production, the control of rushes, blackberry, and gorse, pasture establishment, modern aids in the prevention and control of livestock diseases, the 1952 International Grassland Congress, agricultural education as a national problem, and the future of the dairy industry.

On the last day, Friday 19 June, the conference will deal with problems of dairy farmers. Talks will be on the maintenance of a commercial dairy herd, controlled versus uncontrolled grazing in dairy production, layout of the dairy farm, future developments in the pig industry, infertility in dairy cattle, and bloat in relation to grazing behaviour.

◆

Winter Show Dates

THE dates of winter shows to be held between the end of May and the beginning of July are as follows:—

*29 and 30 May; 1, 2, and 3 June—Otago A. and P. Coronation Show at Dunedin.

*26, 27, 28, 29, and 30 May; 1 and 2 June—Waikato Winter Show Association at Hamilton.

*10, 11, 12, and 13 June—Taranaki Metropolitan A. and P. at New Plymouth.

18, 19, and 20 June—Te Kuiti and District Winter Show at Te Kuiti.

30 June; 1, 2, 3, and 4 July—Whangarei A. and P. Winter Exhibition at Whangarei.

* The Department of Agriculture exhibit will be staged at this show.

◆

Value of Nucleus Hives in Commercial Apiaries

By R. GODDARD, Apiary Instructor,
Department of Agriculture, Tauranga

BEEKEEPERS in many areas of New Zealand find it increasingly difficult to build up standard colonies to full strength in time for the main flow of nectar, often because wind and rain hamper them in their seasonal manipulations. On the other hand, a few beekeepers in favoured localities are embarrassed each year by the early strength of their colonies, and a large percentage of their time in spring is taken up carrying out swarm control measures. The judicious use of nucleus hives will help to overcome both these problems.

APIARY locations must be considered when a decision is made about the best time of year to make up nucleus colonies. As in all phases of beekeeping, planning is essential if good results are to be obtained, and the beekeeper must first consider how the bees are to be housed. A division board can be used in the standard super, thus making use of equipment which is readily available. When this type of nucleus hive is being constructed the entrances to be used by the bees should be at opposite ends of the super. An auger hole makes a satisfactory entrance. It is also advisable to tack the mat to the division board, thus preventing the bees from intermingling when the hive is opened for examination. These nuclei can be placed over division boards on top of standard hives, piled one on top of the other, or set out in the apiary. However, for ease of manipulation and for better results with mated queens the standard four-frame nucleus super is preferred by many beekeepers.

Preparation of Nuclei

Before nuclei are made up the parent hive should be examined closely for any signs of American foul-brood (*Bacillus larvae*). Heavy outbreaks of foul-brood disease in commercial yards have been traced to ignorant or careless beekeepers who prepared nuclei from diseased colonies. Similarly, hives showing signs of *Nosema apis* disease (spring dwindling) should not be used.

HEADING PHOTOGRAPH: Nucleus hives placed in the apiary provide a ready source of young queens and brood for immediate use. Rendell's Photo Service photo.

A few days before it is desired to make up nuclei it is a good plan to open up the chosen colony and select the required number of capped brood combs, gently shake them free of bees, and place them above a queen excluder. The nurse bees will very soon be attracted to the brood above and in this manner supplies of brood and bees are quickly available when required and no time is lost searching for the queen. A minimum number of field bees also are taken to the newly formed nuclei.

Another method is to slip a queen excluder between the two brood chambers of the hive. After 3 or 4 days an inspection of the colony will show in which super the queen is confined.

In areas where there is a quick spring build-up of bees nucleus hives can be prepared without affecting colony strength substantially. Brood combs from the upper portion of a Demareed stock may be used for this purpose. Thus the preparation of nuclei and swarm control are carried out in the one operation. However, too much brood and too many bees should not be taken from the one hive, as this may mean sacrificing the current season's honey crop. Frames of brood may also be taken from weak colonies which would not normally build up sufficiently to catch the main honey flow. By this means the colony itself is reduced to the state of a nucleus. However, if it is not desired to weaken one hive, frames of brood and bees may be taken from several different hives, but care should be taken to see that the queens are not removed.

In a four-frame nucleus two frames of emerging brood and bees and a frame of pollen and honey with space left for a feeder are all that is necessary. When the nucleus has been prepared in this manner the entrance should be blocked with grass, or gauze if the weather is extremely hot, and should be kept closed for at least 24 hours. The nucleus can then be transferred to another yard or left on the original site, preferably away from the parent colony. Although most field bees will probably return to their own hives, the nucleus will be of good strength if sufficient nurse bees were taken in the first instance.

[*Commercial Studios photo.*

Using a division board to keep a spare queen or nucleus hive above a full-sized hive.

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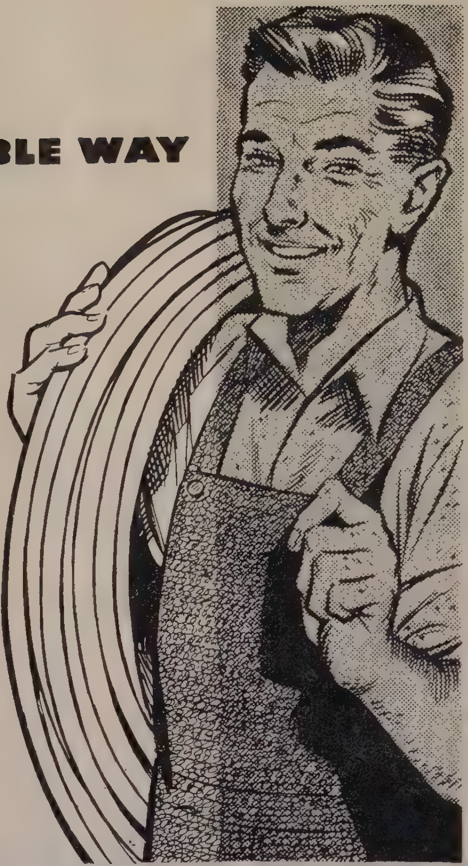

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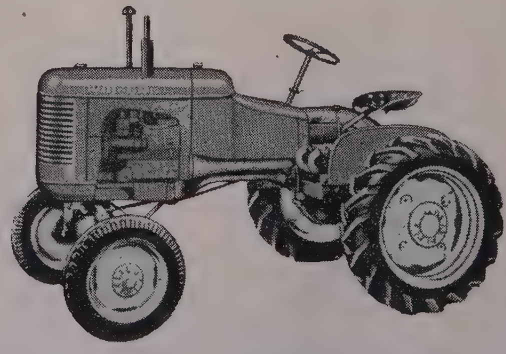

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Requeening

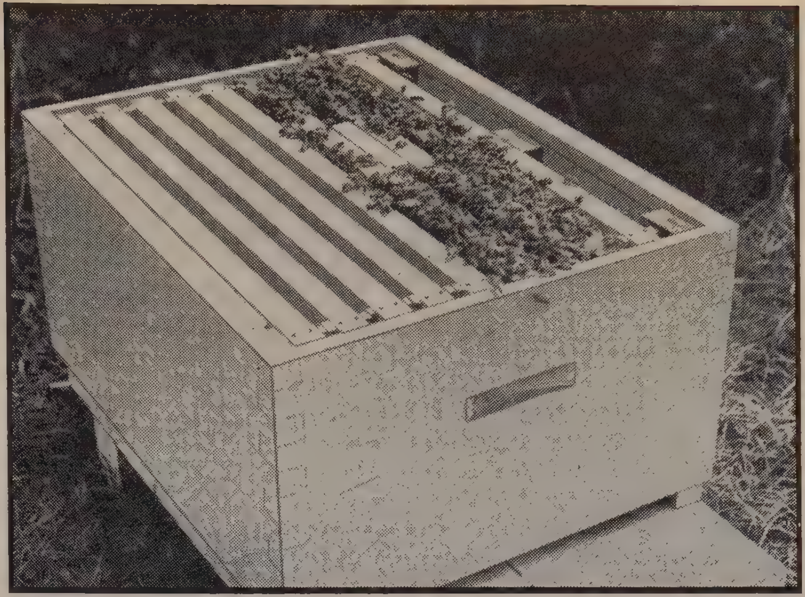
Most commercial beekeepers have their own methods of raising queens, but if spring requeening is carried out, it is a waste of time and bee force to have virgins mate from honey-producing hives. Before a nucleus is given a queen cell the bees should be fed liberally with sugar syrup. If this is done, good acceptance of the cell should be achieved. After the cell has hatched and the virgin is mated and laying she can be removed and introduced to the colony it is proposed to requeen. Another queen cell should be given to the nucleus immediately the queen has been removed. If a cell is not available, the nucleus will rear its own queen, but under this system the best type of queen may not be obtained.

As good queens are essential for successful commercial beekeeping, each queen should be examined carefully before she is removed from a nucleus and introduced to a honey-producing colony. She should be bred from good stock, be properly mated, and have a healthy appearance and a long, deep, moderately-tapered abdomen.

The following method of requeening with nucleus colonies is successful. Nucleus colonies are made up in the normal way and placed over division boards on top of every standard colony. Each nucleus is given a queen cell, and when the queens are mated and laying the division boards are removed and the nuclei united to the parent colonies by the paper method. The young queens will invariably seek out and kill the old queens.

If it is desired to retain a nucleus for future use, the division board can be replaced after a few days, provided that care is taken to ensure that the young queen is down below in the brood chamber. A further cell can then be given to the re-formed nucleus colony.

This method of requeening has many advantages and robbing is practically eliminated, but the greatest advantage is the saving in the time and hard work involved in searching for the old queen.



[Ellis Dudgeon photo.

A nucleus colony in position next to a feeder.

Advantages and Uses

Many commercial beekeepers raise nuclei in special yards which are generally used for queen rearing. This practice has its merits, but additional nuclei will prove of great value if distributed throughout each apiary in a ratio of not less than 20 per cent. of the standard colonies. Under these conditions a danger of robbing exists at certain periods, but the time saved in ease of work and transferring queens, cells, and brood is incalculable.

Perhaps the greatest advantage of nuclei is an ever-ready supply of young queens. The basis of colony population is a queen capable of laying between 1600 and 1800 eggs daily during the flush of the brood-rearing season, and if the colony has ample stores and pollen and is not keeping pace with the other colonies, it should be requeened. The first spring inspection often reveals some queenless colonies, and consequently there is a fairly heavy demand for young queens. A complete nucleus can be united to any colony that has become queenless, as it is most unlikely, except in favoured localities, that queens can be reared successfully very early in the season. A queen placed in a hive at this stage usually means the saving of the colony.

Nuclei can also be used to provide additional brood and bees to help build up colonies which are lagging behind the rest of the apiary. Often a frame of bees and brood added to a colony at the right time will mean the difference between a surplus crop of honey or just a hive of bees. Over-wintered nuclei can be used for making up winter losses. They are also invaluable for drawing out comb foundation, thus freeing the main colonies of this task and allowing them to get on with the main objective, that of producing a crop of surplus honey.

Checking Nuclei

Nuclei need to be checked regularly, and this involves more than merely finding the queen and seeing whether she is laying. Stores of pollen and honey must be watched at all times and feeding carried out if necessary.

To save the nuclei from continued disturbance a block of wood with four sides painted different colours may be placed on the lid. The colour which is uppermost can then indicate to the beekeeper whether the nucleus is queenless, has been given a cell, has a virgin emerged, or has a queen laying. However, any system which enables a beekeeper to walk into a yard and know at a glance the general condition of his nuclei is invaluable.

[Rendell's Photo Service photo.

A portion of a well-sheltered queen-rearing yard.

Ruakura Animal Research Station

By C. P. McMEEKAN, Superintendent, Department of Agriculture Animal Research Station, Ruakura

WITH the formation of the Animal Research Division of the New Zealand Department of Agriculture in 1938, the Ruakura Farm near Hamilton, previously used by the Department as a training school, was taken over by the new division to provide a main centre for animal production research. Outbreak of war in 1939 prevented active development, so that intensive effort to create a centre adequately equipped for animal studies did not begin until 1944.

THE property comprises 870 acres of permanent grassland and maintains the following stock, all of which are used for research: 2000 breeding ewes, 500 dry sheep, 200 beef cattle, 650 dairy cattle, and 40 breeding sows.

Half the area is devoted to studies of dairy cattle and pigs and half to sheep and beef cattle. In addition to Ruakura proper, a hill-country area of approximately 1400 acres of deteriorated land on the Raglan hills, 15 miles from the Station and typical of 6 million acres of similar North Island country, was acquired in 1950. Here an additional 1400 breeding ewes, 600 dry sheep, and 200 beef cattle are carried at present. A target of 4000 sheep and 300 cattle is aimed at on this area.

Ruakura is situated strategically in the centre of the Waikato, one of the most intensive grassland livestock areas of the world.

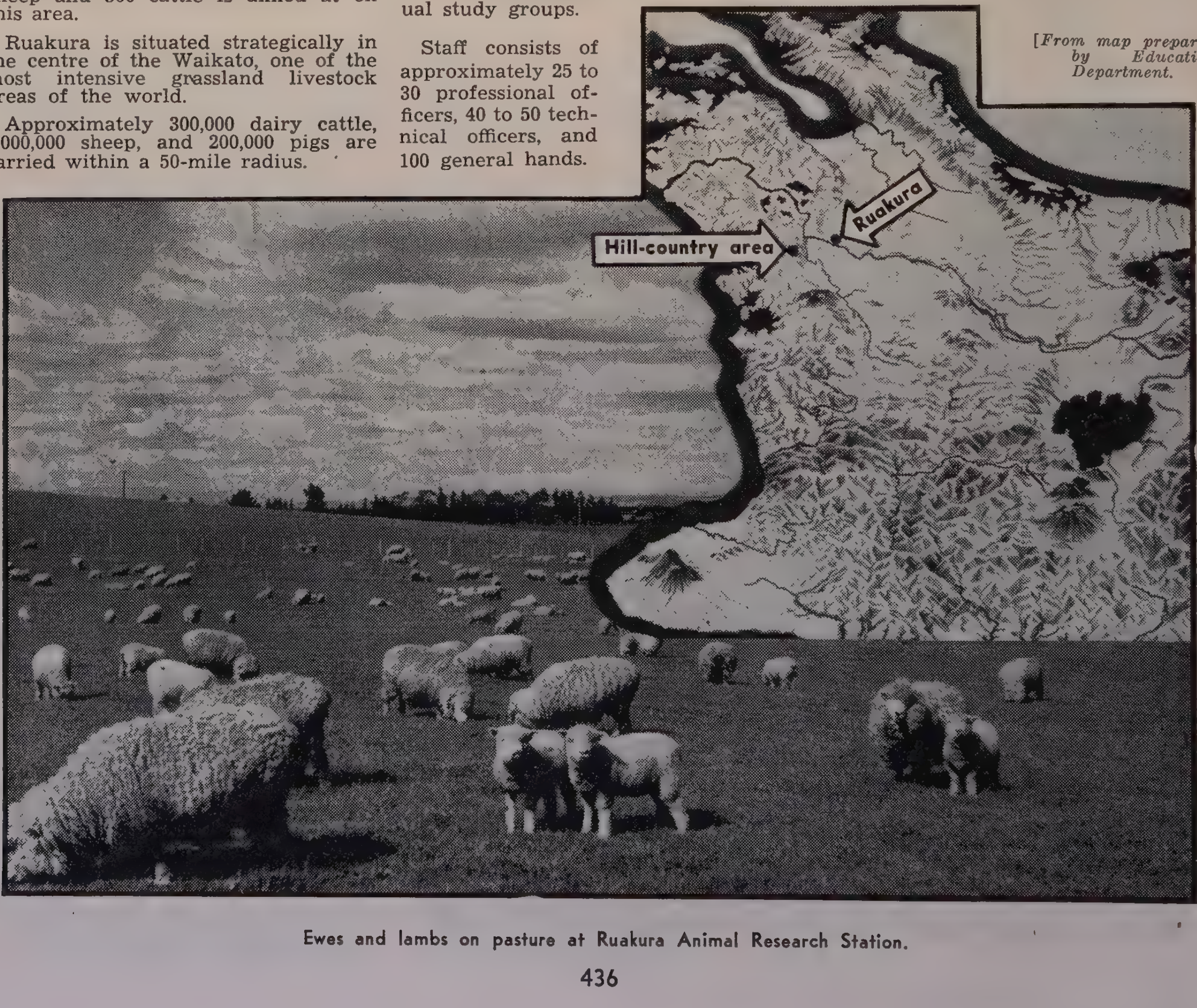
Approximately 300,000 dairy cattle, 2,000,000 sheep, and 200,000 pigs are carried within a 50-mile radius.

The Station is organised as a series of small independent farm units. Each unit is under the control of a specialist research officer and is devoted to the study of a particular problem or group of problems. Thus each worker has individual responsibility for his experimental animals, the land on which they run, the necessary field facilities, and the staff required for the work. At present dairy and sheep studies each involve seven major units. In addition separate sections provide specialist laboratory facilities that are not conveniently replicated, such as biochemistry and biometrics, which service the individual study groups.

Staff consists of approximately 25 to 30 professional officers, 40 to 50 technical officers, and 100 general hands.

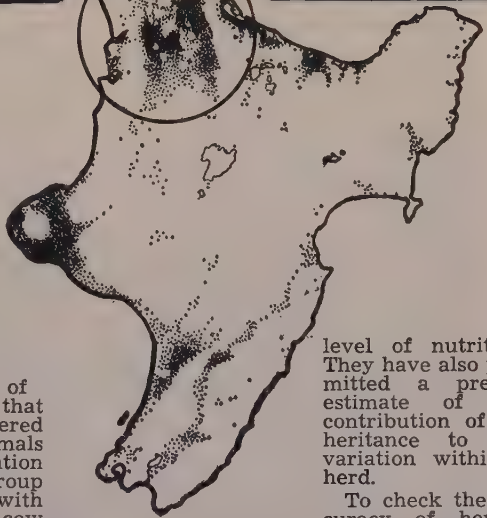
The over-all objective of the Station may be defined as an attempt to place animal production on a factual basis. To this end a wide range of problems of breeding, feeding, and management is studied. Within this general field the Station is concerned specifically with problems of utilisation of pasture rather than with problems of pasture production, which have dominated agricultural research in New Zealand in the past and which are still the main interest of other institutes. It does not handle animal pathology, except in so far as the maintenance of healthy animals and the avoidance of disease are incidental to or associated with production studies. Animal pathology is the special responsibility of Wallaceville, the other major station of the Animal Research Division

A convenient method of describing Ruakura is to list briefly past, present, and probable future activities of some of the major units. Inevitably this method must omit reference to many important associated activities of the



[*From map prepared by Education Department.*

Ewes and lambs on pasture at Ruakura Animal Research Station.



Above—Part of the hill-country station on the Raglan hills. At right—This map, showing the distribution of dairy cows in the North Island (each dot represents 500 cows) indicates the heavy concentration of stock in districts close to Ruakura. The area within a 50-mile radius of Ruakura is enclosed by the circle. From map prepared by Dr. W. M. Hamilton, Department of Scientific and Industrial Research.

more fundamental type that do not require large animal populations and land areas.

Dairy Cattle Genetics-Identical Twins Unit

The dairy cattle genetics-identical twins unit of approximately 90 acres, supporting some 60 cows in milk plus young stock, is the centre of activity for identical twins. Here twins are regarded primarily as material for studying the genetics of dairy cattle, for which they are peculiarly fitted. The opportunity of having the same animal in two different places or under different treatments at the same time provides a unique means of evaluating the complexes involved in the nurture versus nature problem so fundamental to genetic improvement in livestock. In addition close study of the physical and physiological traits exhibited by twins provides important information on the inherited nature of a wide range of characters. Over 300 sets of twins have been studied so far.

Initially work was concentrated on uniformity trials to measure the degree to which twins differed when treated alike. This laid a foundation for future twin work and led to the development of efficiency values for each character studied. These values assess the relative usefulness of twins as experimental material and in addition provide some measure of the heritability of the characters concerned. Twins have been shown to be so uniform when treated alike that they are many times more efficient than non-twin stock for any short-term experiments of up to one or two lactations in length. In consequence, twins are now being used extensively at Ruakura in all major dairy units.

In view of the importance of pasture and the realisation that pastures cannot be considered without relation to the animals grazing on them, special attention has been devoted by this group to grazing-behaviour studies with twins. Over 3000 24-hour cow days have been followed under a wide range of pasture types, weather conditions, and grazing methods. In consequence, there is now a much greater appreciation of the pasture-dairy cow complex as a basis of a better understanding of, and the development of, new grass utilisation practices.

Performance under Different Levels of Nutrition

A complex experiment has been completed to measure the performance of identical animals under different levels of nutrition, with a view to measuring the relative contributions of environment and inheritance to milk production. This study, employing high, medium, and low levels, is of fundamental importance to selection and improvement methods. Results challenge the traditional belief of British animal improvers that selection for a character like milk yield can be effective only under a high level of nutrition. They have also permitted a precise estimate of the contribution of inheritance to the variation within a herd.

To check the accuracy of heritability estimates derived from this and other twin studies, and to test the hypothesis that identical twins, owing to the same pre-natal environment, may be more alike than they should be, a uniformity trial involving 15 sets each of fraternal and identical twins has been begun.

Results from grazing-behaviour work, as well as developments within the dairy industry, have indicated the need for more precise information on grazing methods. Comparisons have been made of the relationship between break grazing and the incidence of bloat, and of paddock grazing versus break grazing in the utilisation of pasture.

An extended visit to Ruakura by Dr. C. W. Turner, of the University of Missouri, has led to the use of twins for endocrine studies. Experiments involving the relationship of estrogen, progesterone, and thyro-protein to milk production in twins in various

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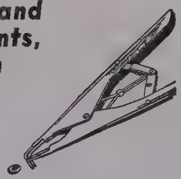

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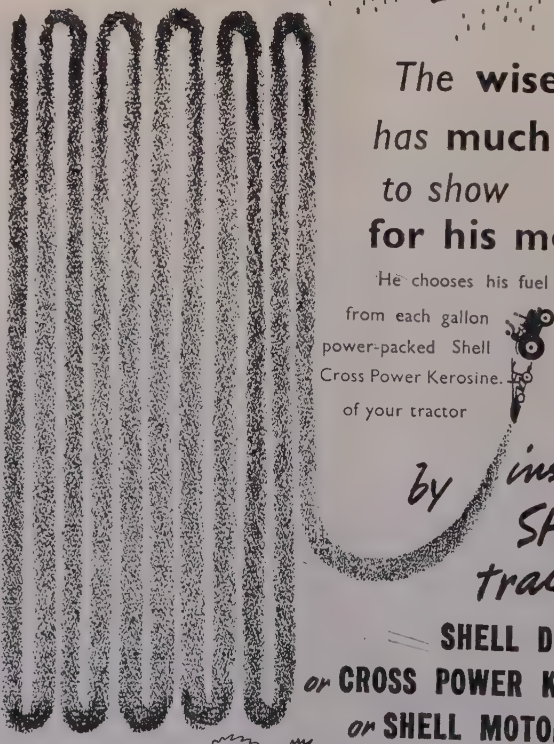

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physiological states have been undertaken.

A co-operative experiment with the Fiji Department of Agriculture on the effect of climate on dairy production is also in progress. Twins split between Ruakura and Sigatoka are being maintained under conditions where the only major difference is climate. Production, growth, and physiological reactions are being followed. Apart from its fundamental interest, this work should provide a rapid answer to the Fiji problem of deciding whether unsuitable nutrition, lack of adaptability of British stock to tropic environment, or both are responsible for poor dairy performance in that country.

Dairy Cattle Improvement

The dairy cattle improvement unit, comprising 126 acres, and carrying 110 to 120 cows plus all replacement stock, is undertaking a long-term experimental study of artificial breeding and progeny testing as methods of lifting the production level of dairy cattle by breeding. Environment has been stabilised by the use of a standard system of management based entirely on grass, hay, and silage, so that changes in production level may be reasonably attributed to improvement through breeding.

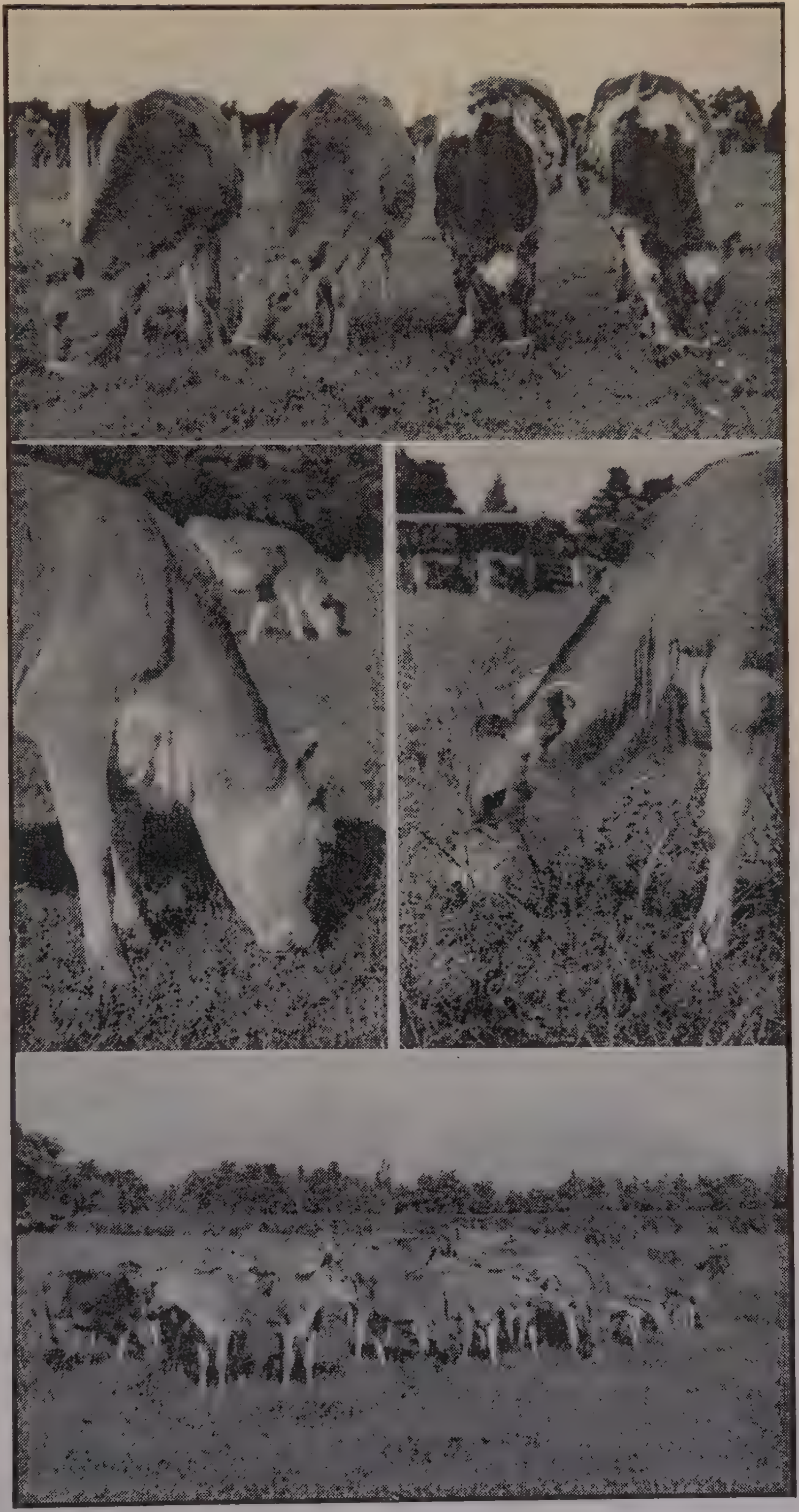
Two average-sized herds, each of approximately 50 cows, are involved. With the first, a grade Jersey herd, the objective is to see how quickly and efficiently a low-producing herd of approximately 250lb. per cow butterfat standard can be raised to 400lb. level. With the second, a pedigree Jersey herd, the object is the maintenance of a 400lb. level indefinitely on grass alone. Each herd is linked to a large number of commercial herds with which the same sires are used, so that results attained under controlled environment conditions can be contrasted with those under a wide range of environments. In this way a reasonable assessment of applying the methods to the national herd is hoped for.

Although it is dangerous to attempt to assess the results of any breeding study after only a few years, the production performance of the grade herd has been raised in 5 years to 380lb. butterfat average. Since a large proportion of the cows are still immature, the herd is thus already of a 400lb. standard. The technique has succeeded also in maintaining a 400lb. standard in pedigree cattle. The results recorded to date in outside herds indicate that the level of performance of artificially bred cattle by proven bulls is affected materially by the standard of management of the dairymen concerned as well as by the quality of the bulls used.

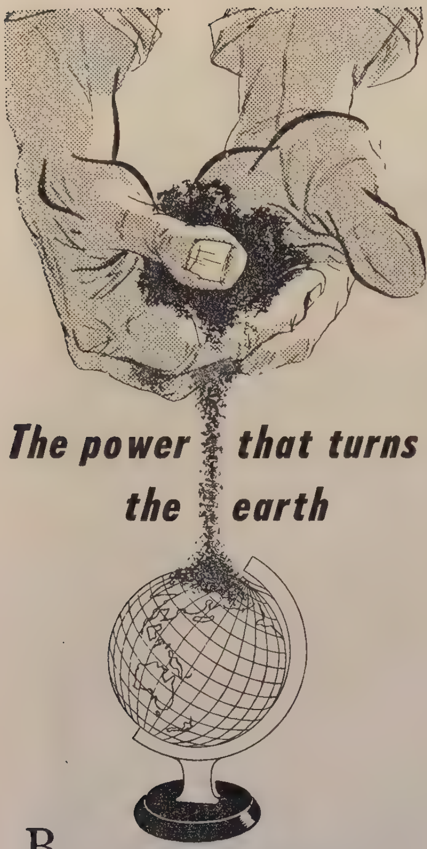
Animal Nutrition Centre

The animal nutrition centre handles the more fundamental problems of pasture nutrition. Approximately 80 identical twin cattle plus all replacements are carried on 100 acres. A small number of sheep are also used for digestibility studies.

The nutrition team has been occupied for some years with the basic problem of measurement of intake of



Upper—Monozygotic twins—two of the 300 sets of twins used at Ruakura on genetic and other experimental studies. Middle—Comparison of long and short pasture in grazing-behaviour studies. Lower—Early-weaned calves 16 weeks old (the normal weaning age) which were weaned at 8 weeks and then reared wholly on pasture.



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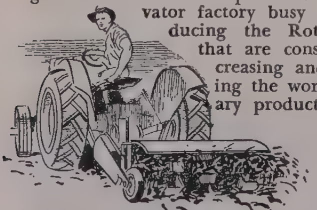

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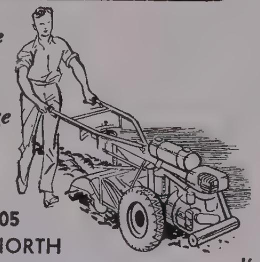

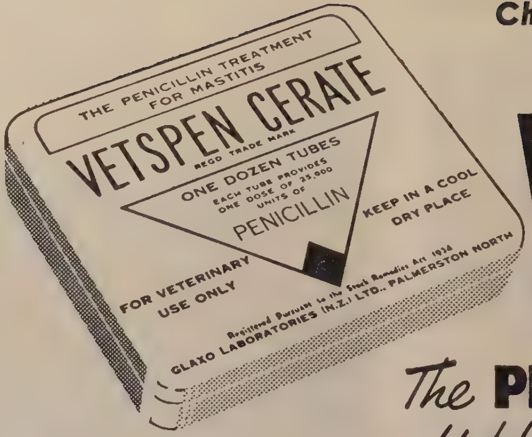
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One of the five dairy shed units at Ruakura.

free-grazing animals. A major limitation to an understanding of nutrition of such stock is inability to measure the quantity and quality of grass consumed. At Ruakura this task has been approached by the indirect method of measuring the amount consumed through the amount of faeces voided and of assessing the quality of nutrients involved through digestibility. The chromium oxide marker technique has been adapted to dairy cattle to cover faeces output.

A marked advance was made by the discovery that digestibility of pasture consumed by sheep and cattle could be estimated accurately from the percentage of nitrogen in the faeces, thus eliminating the laborious procedure of standard digestibility trials, which are subject in any case to considerable sampling errors. A routine has been developed involving dosing of dairy cattle at each milking with chromium marker, taking a grab sample of faeces at the same time, and analysis of this sample for chromium and nitrogen to provide an estimate of the amount of digestible organic matter consumed per day. Work is continuing to increase accuracy. Thus the recently developed American technique of chromagen estimation in faeces as a digestibility index is being followed up as a possible improvement on the Ruakura nitrogen method.

The method is being applied in a fundamental study of the energetics of dairy production on pasture. The main aim is to ascertain how consumption of pasture by dairy cattle grazing freely is related to level of production, liveweight, and changes in liveweight during lactation. These relationships must be elucidated if proper understanding is to be obtained of the more important factors affecting the efficiency of dairy cows as converters of food to milk and butterfat under grazing conditions. A formula has been developed whereby the digestible nutrients consumed by a dairy cow may be estimated from the knowledge of her production, mean liveweight, and changes in bodyweight during the period. Thus, the gross efficiency of cows in terms of food used per pound of butterfat can be assessed.

If this equation can be substantiated by current and future work, its importance to New Zealand dairying is difficult to over-emphasise. It really embodies a feeding standard for pasture-fed cows comparable with the feeding standards of European and American countries, which have been derived much more readily under stall-feeding conditions. It could be used not only to estimate the amount of herbage consumed on a dairy farm, but to classify cows within any one herd in order of merit in regard to the contribution each makes to the over-all efficiency of the herd on a butterfat-per-acre basis. This order of merit is certainly different from that obtained when dairy cattle are classified, as at present, merely on the basis of butterfat production per cow. This technique could conceivably alter the whole basis of dairy cow selection in New Zealand.

Grazing-behaviour studies with identical twins, in which work over 3000 24-hour cow days have been observed under a wide range of pasture types, weather conditions, and grazing methods.

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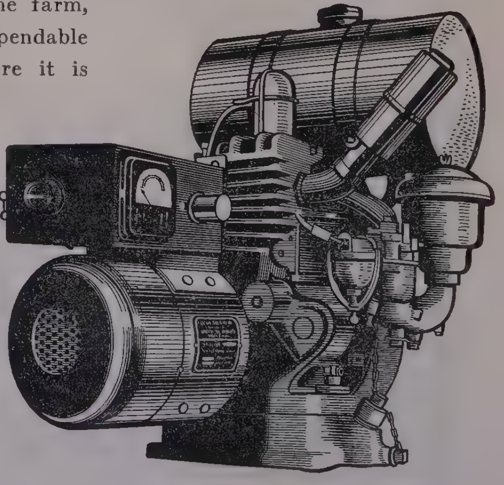

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Cost of Foraging and Grazing is High

Data indicate that the cost of foraging and grazing is high, requiring approximately a 50 per cent. addition to the standard maintenance cost as measured on European stall-fed cattle. These studies are being continued under two widely different levels of nutrition to determine whether the existing formula will cover extremes in feeding. The work will be extended also to cover cattle of different breeds, particularly those showing extremes in bodyweight, and cattle of widely different levels of production.

On the more applied side the aim is to spotlight the short-term weaknesses in New Zealand dairy nutrition methods The influence of feeding during the dry period upon next season's production of dairy cattle has been followed over a 3-year period and substantial effects of good and poor feeding before calving have been demonstrated. Studies on the supplementary feeding of dairy cattle during other key periods during lactation are also under examination The general objective is to break the lactation period up into critical phases with the object of determining the relative importance and best way of handling feeding in each.

Continuous studies have been in progress to measure the nutritive characteristics of New Zealand pastures and forages and the influence of major factors affecting these. The aim is to build up a factual picture of all animal foods here in terms of feeding value, so that there is no longer dependence on data derived in the Northern Hemisphere. Pastures of various types at different stages of growth under different management and utilisation conditions are under constant study. Silages and hays also are examined. Special forage plants like pampas, lucerne, and paspalum have been the subject of separate work. The unit will soon proceed to intensive examination of the quantitative and qualitative aspects of meal supplementing of pasture in the nutrition of dairy cattle.

Use of the electric fence for break grazing in pasture nutrition studies.

Nutrition of Dairy Calves

The nutrition of dairy calves on milk and pasture is also a special interest of this group. Attention has concentrated mainly on pre-weaning feeding and management. Work on the level of feeding has been designed to provide a ration that will effect maximum economy without limiting growth. A level of 15 per cent. of bodyweight in milk per day is indicated as the optimum. Early-weaning studies have shown that grazing calves can be successfully reared on whole milk alone or whole milk and separated milk, even when weaned at 8 weeks, when they are approximately 100lb. liveweight.

Combining early-weaning and level of feeding studies, the feeding of a standard amount of milk per day, approximately 7 to 8 pints, to a Jersey calf for 8 weeks has given as good results as a standard system of calf feeding where weaning is prolonged to 16 or 18 weeks and where the amount of milk is increased as the calf gets older. More fundamental work aims at measuring digestibility of pasture by calves, the relative changes in development with age and type of nutrition of the four stomachs and other digestive organs, the capacity of calves to digest cellulose, and the grazing behaviour of calves under different pasture and climatic conditions.

Long-term Dairy Cow Nutrition

In this long-term dairy cow nutrition unit 128 acres of relatively poor-quality land carry 100 milking cows plus all replacements. The project involves investigation of the relationship between four major types of pasture nutrition and production performance of dairy cattle over their lifetimes. The variations in feeding are typical of systems in use in the industry. The experiment is designed to cover 15 years or three average cow lifetimes.

More specifically the study aims to elucidate the precise effects of good and poor rearing on growth, reproduction, production, and length of life of dairy stock. In addition two systems of pasture nutrition are compared during lactational life. A high, even level of nutrition, with emphasis on full

In the dairy cattle improvement unit environment has been stabilised by the use of a standard system of management based entirely on grass, hay, and silage. Above—Baling hay and loading bales with a mechanical loader. Right—Harvesting silage with a green-crop loader.

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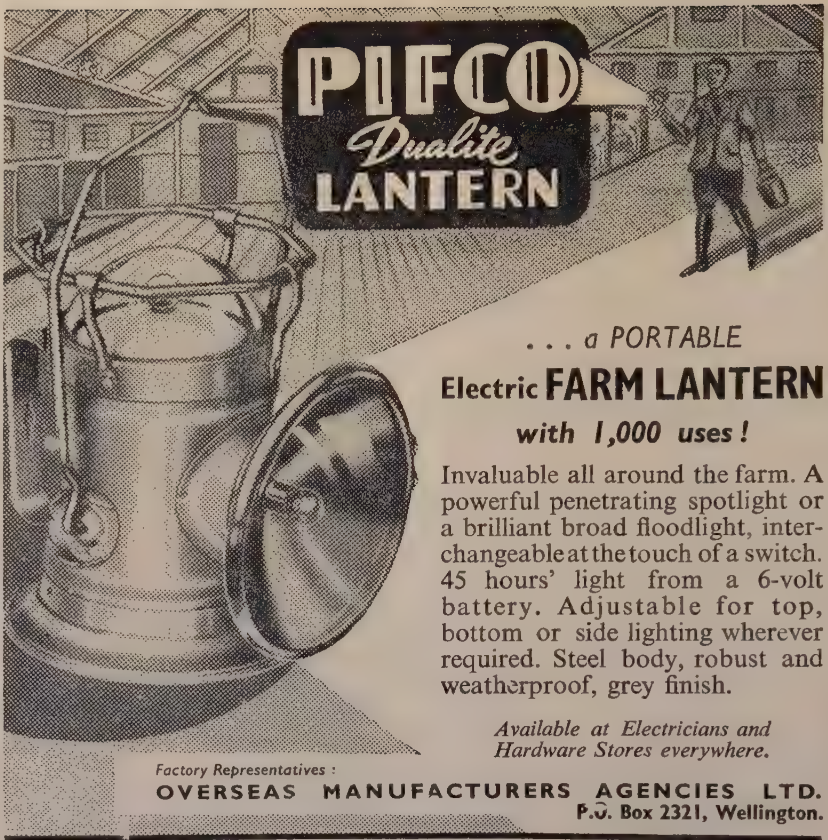

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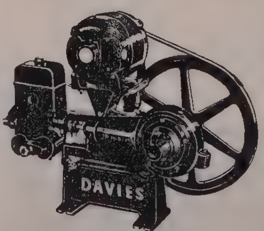

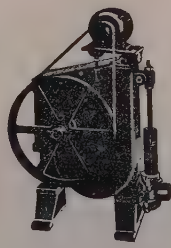

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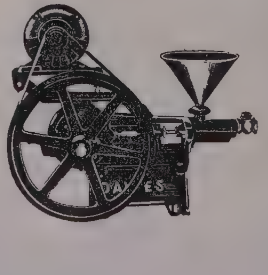

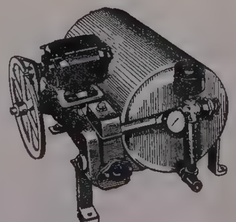

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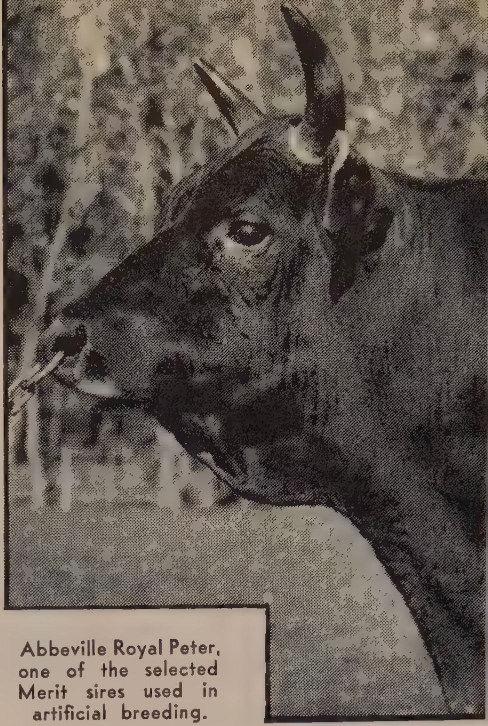

Abbeville Royal Peter, one of the selected Merit sires used in artificial breeding.

feeding and even-level feeding at all times, is contrasted with a fluctuating level where intake is subject to the normal ups and downs of seasonal food supply from pasture. The experiment is also designed so that it gives annual data on the production results of two contrasting systems of farm management, where all modern techniques normally associated with good grassland farming are compared with a system of extensive set-stocking management with no special care being taken to protect the animals from seasonal fluctuations in food supplies.

Results after 8 years show that, though poor growth in early life restricts the production of a dairy cow during her first two or three seasons, her capacity to recover from the influence of early under-nutrition permits her closely to approach well-reared mates by maturity. Marked effects of early rearing on reproduction in favour of poor growth in early life have been demonstrated. On the farm management side the controlled grazing farm has outproduced the uncontrolled farm by approximately 50lb. per cow and 40lb. per acre over the last 5 years. It is clear, however, that these results are influenced markedly by season, so that particularly favourable grass years have given almost as good production from the uncontrolled grazing area. It is too early yet to detect any significant effects on herd wastage or length of life.

Specific information is being obtained on the relationship of level and type of nutrition to growth in bodyweight and skeletal size, on the blood status in respect of important mineral and organic constituents associated with metabolic disorders, and the composition as well as the quantity of milk produced.

The influence of pregnancy on liveweight of dairy cows has been measured. Slaughter, dissection, and weighing of the gravid uterus at monthly intervals from conception to full term, together with accurate measurement of losses at calving, each on large samples of 100 cows or more, have permitted the construction of correction factors which enable liveweight changes in dairy stock to be followed without complications due to pregnancy and thus the measurement of nutritional effects with greater precision.

This unit has also been responsible for the development of the rotational grazing management system of rearing dairy calves now widely applied in New Zealand. It has been shown that the method overcomes completely lack of thrift and mortality in dairy calves characteristic of set-stocking methods previously typical of the industry.

Milk Secretion and Milking Methods

A small herd of cows (10 to 20) is maintained for basic studies of milk let-down, with special reference to milking methods and to the design, construction, and use of milking machines. Identical twins are used in most studies.

It is assumed that efficient machine milking is dependent primarily on the interaction of three factors: The physiological process of milk let-down, the milking machine, and the milker. The first of these has taken the milk secretion team into complex studies of the endocrine control of milking behaviour, and some contributions have been made toward a better understanding of the way in which a dairy cow milks. In particular, milk let-down has been shown to be due to the oxytocic hormone, and not to special pituitary let-down hormone as had been postulated in some quarters. Certain other chemical substances have also been shown to have let-down activity. Contrary to previously held beliefs, multiple let-down during a single milking has been demonstrated in a sufficient number of cows to indicate that this phenomenon is a practical problem in efficient herd milking. Numerous studies on the inhibition of let-down and in particular the effect of the hormone adrenalin (the preparation containing the active principle of the suprarenal gland) have been carried out which have contributed to a better understanding of the reaction of cows to various milking procedures. The effects of different milking techniques, such as non-stripping, methods of pre-washing, and general shed routine, on the efficiency of milking have been studied with a view to developing the best all-round regime.

Milking Machine Research

Much has been done on milking machine design, based on a thorough study of the part played by the machine and its various components. Rate of withdrawal of milk has been shown to be the major criterion of efficiency

BELOW: Artificially bred daughters of proven bulls in Ruakura breeding experiment.

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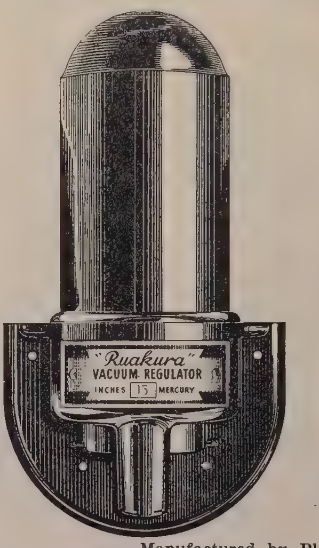

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in a milking machine, and a technique for measuring this rate under all conditions has been developed. The method is now in use in many other countries. Detailed specifications for various components of the milking machine have been developed. An efficient relief valve for the control of vacuum level and a milk-flow indicator for accurate timing of the milking process have been designed, tested, and placed in commercial production. These two components are the key to overcoming many of the problems associated with poor milking machine performance and practice.

Present work involves a continuation of basic hormone studies, using the sow as an assay animal, for which it has been found to be peculiarly adapted. The group is interested in mapping the distribution of let-down hormone in various parts of the pituitary gland of different species. A technique for measuring intra-mammary pressure has been developed recently, and a number of studies are in progress on the relationship of udder pressure to the behaviour of the gland.

Work on the milking machine itself is concentrated on the improvement of vacuum pumps, releasers, and pulsators. Testing equipment to provide a scientific basis to servicing of milking machines has been designed and is being used to provide a testing service for dairy farmers.

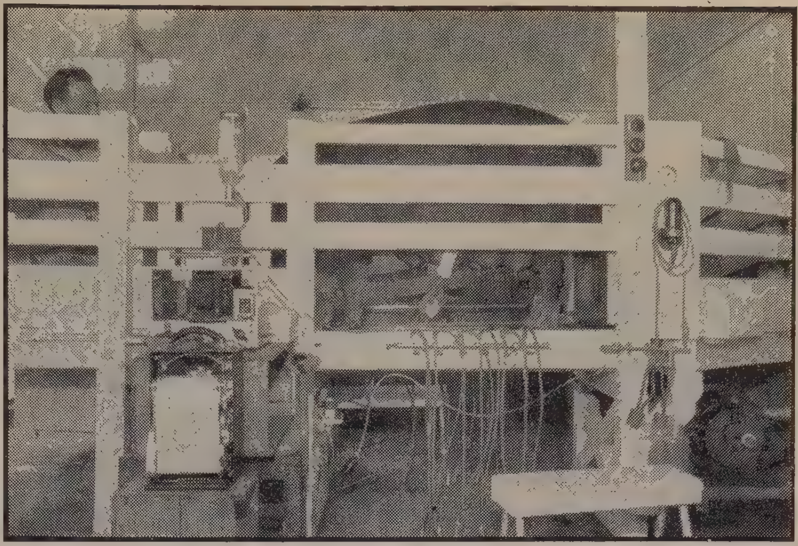
Bovine Fertility

The bovine fertility unit has sufficient accommodation for 50 bulls, 20 of which can be maintained in stalls. Activities cover three main fields: Artificial breeding, male fertility, and female sterility.

Owing to the specialised organisation of the New Zealand dairy industry on a seasonal basis, the application of the technique of artificial insemination breeding has involved problems peculiar to this country. The objective has been to develop techniques capable of giving in one month the coverage per bull normally attained in Europe and America in 12 months. Special interest has attached to the use of aged proven bulls for such work, since artificial breeding has little interest to producers except as a means of herd improvement. Herd sizes are sufficiently large in New Zealand to carry the cost of private maintenance of bulls of reasonable quality.

Research has involved not only intensive laboratory work, but the development of field methods suited to the special needs in this country. Investigations have been on a strictly experimental basis, herds involving 1000 grade cows forming a nucleus experimental group. The effect of a wide variety of factors on the efficiency of artificial breeding has been studied. Thus the team has investigated the influence of dose rate, of methods of preservation with antibiotics and drugs, methods of transport and storage, of storage time, and of age of bull, as well as other possible modifying factors. In future special interest will attach to studies of deep-freeze preservation methods which, if successful, could completely alter the whole artificial breeding potential in New Zealand.

Results have been sufficiently good for the New Zealand Dairy Board to assume control of commercial artificial breeding in New Zealand as from 1952, the intention being to provide a national service for the dairy industry.


Milking a sow by machine in studies of sow nutrition.

Twin Bulls Used in Experiments

The collection of identical twin bulls provided a unique opportunity of initiating experimental studies of factors affecting the sexual performance of dairy bulls. These are important, not only because of the relatively widespread occurrence of infertility in bulls, but in the development of feeding and management methods likely to provide the most efficient lifetime use of a normal bull under both artificial and natural mating conditions. Over the past 5 years approximately 10 to 15 sets of twin bulls per annum have been involved in experiments designed to measure the precise influence of such factors as level and type of protein nutrition, concentrates versus pasture feeding, silage feeding, exercise, indoor versus outdoor conditions of management, level of nutrition during rearing, drugs, infection with disease, and excessive use as yearlings. Results have shown that the sexual performance of a bull is extraordinarily hard to influence by environmental control, so that it would appear that this characteristic of the male is determined primarily by inheritance. Although this generalisation is made, the work has shown that severe under-nutrition during the growing period produces harmful effects on sexual ability. On a shorter-term basis bulls so well fed as to be regarded as excessively fat have given a better performance than those in hard working condition. Excessive use during the yearling stage has produced a marked fall in sexual strength by the 3-year-old stage. Studies along these lines are continuing.

Sterility in Female Stock

With females an attempt is being made to map the various types of sterility occurring in dairy herds by pre- and post-mortem examination of cows of known reproductive history culled for sterility from the experimental artificial breeding herds. The general objective is to determine the more important forms that exist, so that research can be concentrated on those warranting special study. As a result of this work, trichomonas foetus (one of the parasitic organisms which cause abortion) has been discovered to exist throughout the whole of the North Island dairying districts to a degree constituting a major problem.

Basic studies on the physiology of sperm, on the bacteriology of semen with special reference to conception rates, and on delayed ovulation as a cause of failure to conceive are in progress. The effect of hormones (secretions produced by a gland which pass into the blood stream) on stimulation of sexual activity is also being examined. An assessment of the value of testicle palpation, or manipulation by hand, as a means of diagnosing levels of fertility of rams under field conditions has shown that method to give satisfactory results.

Pig Husbandry

Some 600 pigs are used each year for experimental work. Studies of sow nutrition have become the major interest of the pig husbandry group. The importance of milk yield of the brood sow to successful pig production and the development of milk recording methods and machine milking techniques whereby milk yield and quality can be measured accurately have made an experimental attack on problems of sow nutrition worth while.

Various modern breeding plans are under examination. The American technique of inbred crossbreeds as a method of producing commercial pigs showing high-performance characteristics is giving more promising results than either inbreeding or progeny testing.

. . . RUAKURA STATION—448

Part of Ruakura's Aberdeen Angus herd, which is used for studies on meat production.

Attention has been directed toward mapping the precise effects of supplementing dairy by-products with meal concentrates in fattening pigs. Here the level of supplementing and the stage of growth over which supplements are fed are the two main variables studied. It has been shown that 1lb. of average quality meal has the same fattening value as a gallon of separated milk, a figure which puts feeding standards for pigs under New Zealand conditions on a much sounder basis than hitherto. Studies on the level of feeding, the frequency of feeding, the temperature of beds and houses, and the place of pasture in pig nutrition are in progress.

Nutrition of Breeding Ewe

The unit studying nutrition of the breeding ewe, involving 50 acres and a flock of 300 breeding ewes, is used primarily to measure the relationship of various methods of feeding breeding ewes to performance. Attention is focused on determining the periods during which feeding is most important.

Initial work has involved the transfer of methods examined on a laboratory hand-feeding scale at Cambridge University to field conditions and pasture nutrition. Special attention has been directed to pre-lambing nutrition, and over a period of years the effect of three levels of feeding during the last 5 weeks of pregnancy has been measured. The work has provided further evidence that the precise results so frequently obtained under carefully controlled conditions involving individual feeding cannot be duplicated under free-grazing, group feeding conditions. Rather do they tend to be minimised by the wide range of individual response normally existing within each treatment. Thus an extremely low level of nutrition during the later stages of pregnancy, such that no gain in weight was made despite the marked increase in weight of the rapidly developing foetus, failed to produce any material effect on the subsequent growth of lambs. Only the weight and quality of the wool of the ewe were adversely affected by severe pre-lambing underfeeding.

Concurrently an attempt has been made to investigate the phenomenon of flushing in precise terms. As a result of several years' work the data obtained have led to the development of what might be termed an enlightened flushing programme, which aims at taking full advantage of the way in which nutrition reacts on the shedding of eggs by the ovaries.

This group has also been interested in mortality in new-born lambs. Continuous observation of a flock of 300 ewes lambed down individually has provided a great deal of information on what actually happens at lambing, on the causes of loss, and on methods of control.

Post-lambing nutrition of both the ewe and the lamb is now under study, the area at present being used for a comparison of set-stocking with rotational grazing in the management of fat lamb flocks under differential carrying capacity conditions. The unit is also specially interested in determining the optimum length of bite of pastures for sheep as it affects both pastures and sheep. A systematic attack on the nutritional efficiency of early weaning will also be made.

Adaptation to sheep of the technique worked out for dairy cattle for the measurement of intake is being attempted. So far considerable difficulty has been experienced in evolving a marker method for the measurement of faeces output, though the faeces nitrogen method of estimating digestibility has applied equally well.

Meat Production

Approximately 150 to 200 acres carrying 1000 breeding ewes and 160 cattle has been devoted to fat lamb studies, the general objective of which is to assess the relative importance of the major controllable factors affecting the efficiency of meat and wool production per ewe and per acre. Much ground has already been covered.

Following similar investigations under South Island conditions by the same workers, a 3-year study was

Eight ewes per acre. Part of an experiment to study the relationship between carrying capacity and output of meat and wool per acre in intensive fat lamb production.

made of eight different breeds of ram as fat lamb sires when mated to the Romney ewe. An accurate picture of detailed carcass-quality characteristics of these breeds, in combination with information on the same breeds with the South Island Corriedale or half-breed ewe, has provided factual information on the importance and influence of breed of ram in fat lamb work. In particular, the results demonstrated that a heavier, leaner carcass (and hence increased meat production per ewe) is produced by a heavier type of ram than the standard Southdown. If this heavier, leaner lamb carcass is accepted by the meat industry and Britain, it could lead to a substantial increase in meat exports without any corresponding increase in feed production.

A study of similar duration and size on the relationship of the carcass type of the fat lamb breeding ewe to the carcass of her progeny indicated that extreme differences in the class of Romney ewe were without any effects of commercial importance. Similarly, experimental studies failed to distinguish between carcasses produced from strong-wool and fine-wool ewes. This work has emphasised that any selection margin available in picking ewes can be directed more profitably to other channels.

Effect of Sex Glands on Development

To add to knowledge of the influence of the sex glands on the development of the bone, muscle, and fat complex in the meat animal, a large-scale experimental study of males, females, and castrates of each sex has been completed. Study of methods of castration, with particular reference to the use of rubber rings, which have been criticised on Smithfield market as causing stagginess, failed to demonstrate any harmful effects of commercial significance on either fat lambs or chilled beef carcasses.

Present activities involve an experimental study of the relation of carrying capacity to the efficiency of fat lamb production in all its aspects. Three comparable farms, stocked at the rate of 4, 6, and 8 breeding ewes per acre respectively, are being employed. Data are being collected not only on the relative outputs of meat and wool per ewe and per acre, but on ancillary effects, such as ewe mortality, lambing percentages, lamb mortalities, wool quality, carcass quality, and financial returns. Special interest also attaches to the precise measurement of the output of beef per acre on the two lower carrying capacity farms, where cattle are used to control pastures.

The effects of the relationship between time of shearing of ewes and lambs on growth, quality, and returns from fat lamb production will be the subject of future work.

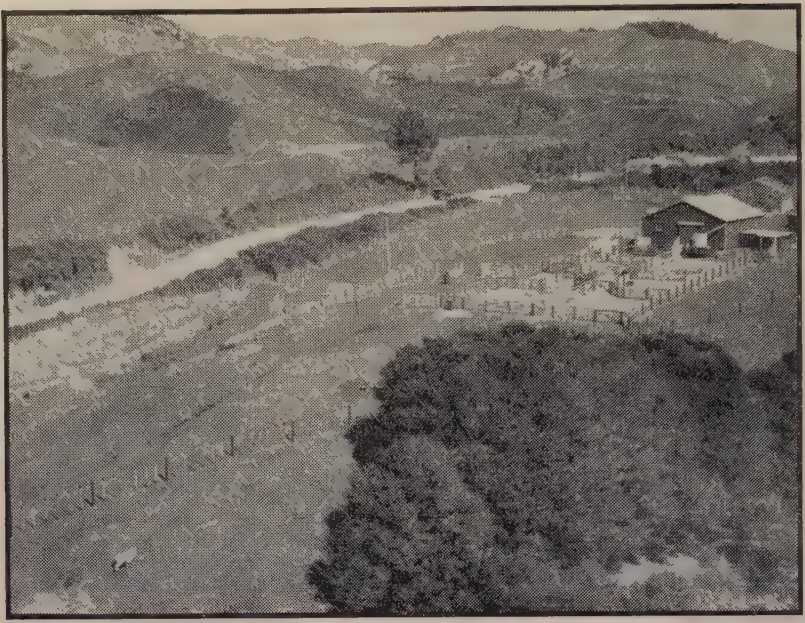
With beef concentration has been on the development of an objective system of carcass evaluation based mainly on measurements to permit accurate experimental studies with this class of meat. A technique has been devised which is also well adapted for judging carcass competitions, for which it is now widely used in New Zealand and in several states in Australia. With use of the method major carcass differences between different breeds and crosses of cattle and different weights and ages have been surveyed as a preliminary to more precise experimental studies. Work is now planned on the influence of the store period characteristic of hill-country cattle on carcass quality and on the effect of age of steer and the influence of level of nutrition during early life on subsequent carcass development. These studies will run in conjunction with the hill-country station, to which half of the Ruakura beef breeding herd has been transferred, so that the herd's performance under lowland and hill-country conditions can be contrasted. A comparison between intensive beef production and intensive lamb production is also planned.

In addition to these applied problems the meat production section is interested in fundamental aspects of growth of the meat animal. Without use of identical twin material in cattle, complete anatomical analyses of both males and females reared under uniform conditions and under different levels of nutrition are being made, so that the growth gradient mechanism of the cattle beast can be worked out and compared with those already obtained for sheep and pigs in this and other countries.

Ewe Fertility and Reproduction

A systematic approach to increasing lambing percentage through breeding is in progress with a flock of 350 ewes. The project has been designed on a strictly experimental basis and three independent flocks are maintained. In the first, selection methods aim at high fertility. In the second, the object is

General view of the class of country taken up for the Ruakura Hill-country Station.



Ruakura Hill-country Research Station.

low fertility. In each of these no attention is paid to other characters save obvious and serious defects. The third or control flock is bred in the normal way, without reference to fertility levels, selection being on the basis of the usual productive characters in Romney sheep.

In selecting for either a high twinning rate or a low rate, emphasis is placed on a history of twinning. Thus a ewe hogget may be selected for the high fertility flock, even though she is a single-born lamb, providing her dam has a history of several successive sets of twins. Similarly, selected rams may not be twins. The reverse technique is used in selection for the low fertility flock. The method thus differs from most attempts of farmers to lift lambing percentage, which are based on straight twin selection. The design of the experiment is such that a measure should be obtained of the effects on the all-over efficiency of sheep when selection is based on a single character like fertility with no attention being paid to wool or carcass.

Hormone Therapy

Increasing of lambing percentage is also being attacked through the endocrine approach. Hormone therapy, using pregnant mare serum, is being employed to increase the ovulation rate and hence the number of young born. This work is being carried out on both a fundamental and applied basis. Through post-mortem examination after injection data are sought on optimum dose rates and optimum times of injection for Romney ewes. In addition the method is being applied to small flocks of ewes to observe full-time effects. Results have been promising, but it is clear that the technique needs both refining and simplifying to avoid too high a proportion of triplets and quadruplets and to bring it within the scope of practical sheep farming.

As a means of building basic information on reproduction in the ewe attempts are being made to measure the hormone status of excretions of sheep. Techniques have been developed for measuring estrogen (a class of substance which promotes oestrus by the introduction of a glandular substance) and other hormones in urine. This work has necessitated the development of a method for collecting urine from the female under grazing conditions. The technique devised permits continuous collection over a 24-hour period.

The estrogen excretion of normal ewes at different stages of the reproductive cycle has been measured to provide a picture of a normal animal. Work is proceeding on the examination of abnormal ewes, with special reference to those suffering from bearing trouble and infertility. The influence of flushing on estrogen secretion is also being examined.

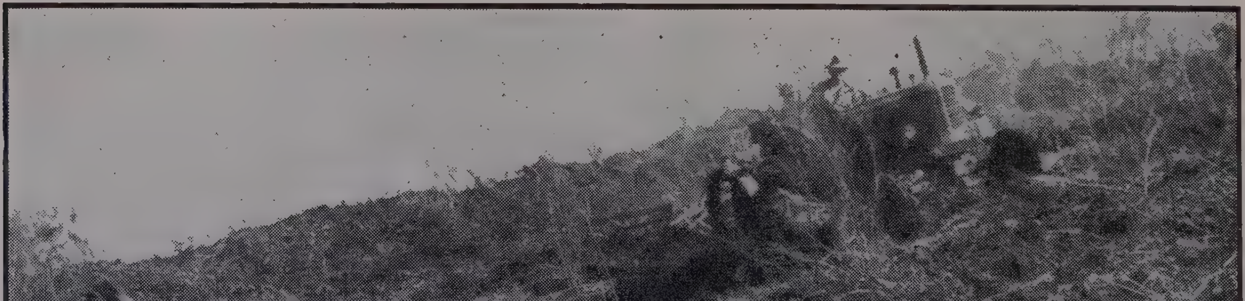
Opportunity has also been taken to examine the possibility of clover-rich pastures containing estrogens harmful to stock. White clover has not been found to contain any such materials, but their presence in red clover grown in the Waikato has been detected.

A considerable amount of attention has been devoted to sterility in ewes, post-mortem and lapdrotomy examinations being used.

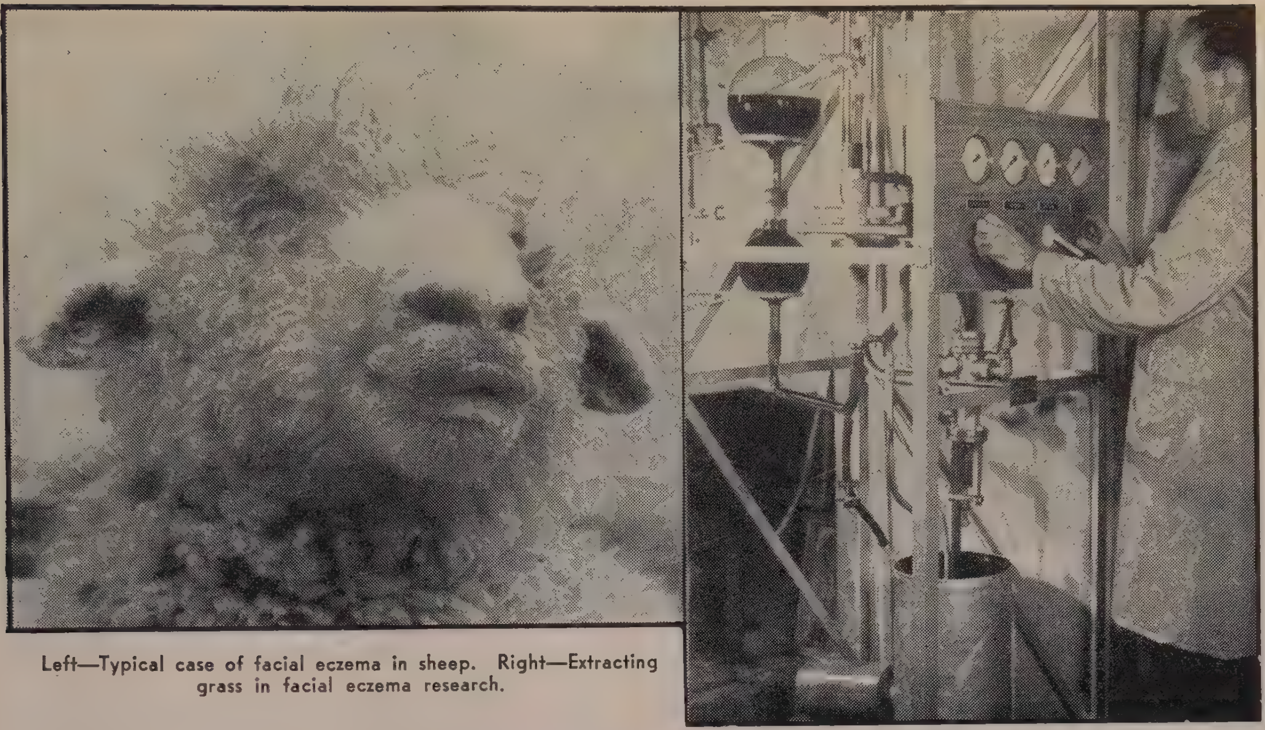
A study of mammary gland development in sheep as affected by the sex glands and by hormone implants of the estrogen type has been made. The results have been compared with cattle glands in comparable studies by the same workers. The effect of light variations as influenced by district will be investigated to assess a possible cause of difference in lambing percentage between Southland and Waikato.

Hill-country Station

Work on the hill-country station during the past 2 years has been concentrated on increasing carrying



Development work on Ruakura Hill-country Station.



Left—Typical case of facial eczema in sheep. Right—Extracting grass in facial eczema research.

capacity and providing the essential field facilities to permit accurate work with stock. Sufficient progress has now been made to permit a start with experimental work.

All the sheep on the property have been under close supervision for the past season and detailed records of individual performance have been collected. This work aims at providing badly needed factual records of the performance of sheep on hill country as a guide to the problems of hill-country farming. The objective here is to pinpoint the major causes of inefficiency.

Few specific projects have yet been started. Work is in progress on hogget rearing, comparisons being made between a long bite and a short bite from weaning onward for such sheep. Drenching comparisons are also included, and subsequent production performance is being measured. Production comparisons are also being made of hill-bred lambs reared from weaning to the 2-tooth stage on the hills with rearing on lowland country.

An attempt is being made to add genes for higher fertility to Romney sheep by introducing a cross with the Border Leicester. To investigate the possible genetic bases of bearing trouble in breeding ewes a special flock has been established for breeding studies. This flock may also yield sheep with a high incidence of bearing trouble for detailed experimental studies.

Work is planned on the relative performance of high plane and low plane of nutrition of breeding ewes, of set-stocking and rotational grazing techniques on the hills, and of various methods of cattle management in relation to the production performance both of cattle and of the sheep with which they are associated. Management in relation to control of weeds and second growth will also engage the attention of this unit.

Biochemical Studies

In addition to providing essential biochemical services to other specialised sections the biochemical section is responsible for independent projects.

Major interest is centred on photosensitivity diseases (those caused by the effect of sunlight on the skin) of grazing animals and in particular the isolation of the liver-damaging substance from pasture producing the disease facial eczema in ruminants. This research has been hampered for many years by difficulties associated with obtaining grass known to be toxic, by the difficulty of getting the toxin into solution, and by the lack of small-scale assays of toxicity of chemical extracts. Reliable field techniques for collection of eczema grass have been developed and the guinea pig has been shown to be a suitable assay animal. A suitable extraction method has been evolved, so that the stage has thus been cleared for a more direct biochemical attack.

An indirect approach also being followed is the isolation of the toxin from millet (*Panicum miliaceum*), which produces liver lesions and photosensitivity similar to those of facial eczema. Work on this plant can be continuous, since it is toxic at all stages of growth. The panicum toxin is retained tenaciously in the plant, but toxic extracts have been prepared, fractionation of which is in progress.

Biochemical studies on guinea pigs to define the chemical pathology of millet poisoning have been carried out, and work has begun on the artificial production of eczema-producing grass by control of environmental conditions affecting pasture growth. This latter approach has not been worth while hitherto because of the previous inability to use small animals for test purposes.

The toxin in ergot of *Paspalum dilatatum* causing tremors in cattle has been extracted and is being fractionated for identification.

To explore the basis of the faeces nitrogen/digestibility relationship developed by the biochemical laboratory, studies on the nature and amount of nitrogenous constituents which are true residues of feed, as distinct from metabolic waste material from the body of the animal, have been begun. Special attention has also been devoted to the lignin (or woody fraction of feedstuffs) in digestibility studies. Work has also been carried out on the problem of determining the nature of the so-called unknown fraction in the composition of animal foods. Progress has been recorded in identifying some of the constituents concerned.

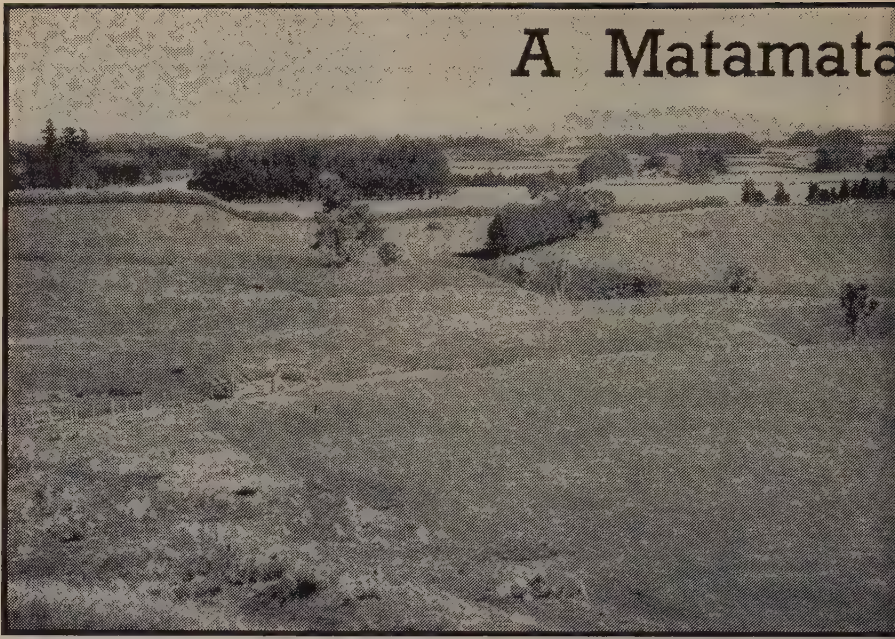
Possible chemical methods of estimating the hormone status of body fluids and organs of sheep and cattle are being examined.

Conclusion

The Station is in its infancy. The major pattern of its work and responsibilities has begun to emerge. It is interested in evolving principles capable of wide application rather than in testing practices of local significance. Its future depends on the success of this policy.

A Matamata

ONCE part of the Mangawhero Block, consisting of 7828 acres, portion of the original Matamata Estate, the dairy farm of 169 acres dealt with in this study in farm management by N. A. Clarke, Instructor in Agriculture, Department of Agriculture, Matamata, is on the soil type Tirau sandy loam. It carries 110 milking cows and all replacements and supplies whole milk to the local factory. Among the factors which contribute to its exceptionally good production are the provision of a supplementary summer crop and the use of newer and better pasture species; a herd which is well bred, efficiently milked, and constantly tested; paddocks which are well sheltered and watered; use of the electric fence; and shutting up paddocks for silage.



THE Matamata Plain, a continuation of the Thames Valley as it rises gently from the coast to the north, is bounded to the east by the Kaimai Range. In the south it rises into the rolling and afforested country bordering the Taupo and Rotorua regions and to the west is bounded by the Waikato River. The plain itself is flat or rolling and varies between the 100ft. and 200ft. contour.

The Matamata County supports a population of just under 1 per cent. of the Dominion total and contains 1461 farm holdings. However, it carries 1 per cent. of the sheep in the Dominion, 5 per cent. of the pigs, 3 per cent. of the cattle, and in it is milked 4 per cent. of the cows. Most of the farming development of the district has occurred over the last 40 years, and in that short time it has become known as one of the most productive dairying districts in the Dominion. Since 1911 the area of land occupied has doubled and the number of cows milked has multiplied eight times. Within a 13-mile radius of Matamata there are five dairy factories which produced in the 1951-52 season 21,596 tons of dairy products with a value of £4,451,205.

The district enjoys the mild and temperate Waikato climate and is not subject to extremes of any nature, although fairly wide variations in seasonal conditions can occur. The average rainfall is 45in. per year and seldom varies outside 40in. to 50in.

Rain falls on approximately 175 days and the distribution is fairly even throughout the year. June and September are usually the wettest months and dry summers can occur every 3 or 4 years.

Approximately 40 to 50 frosts are experienced each winter, but the number has varied from 15 to 80. Most of the frosts are slight, but in 1951 particularly, a large number of hard frosts were experienced. The prevailing wind is from the south-west, but occasionally a north-east wind brings squally weather, which affects mostly the area close to the Kaimai Range.

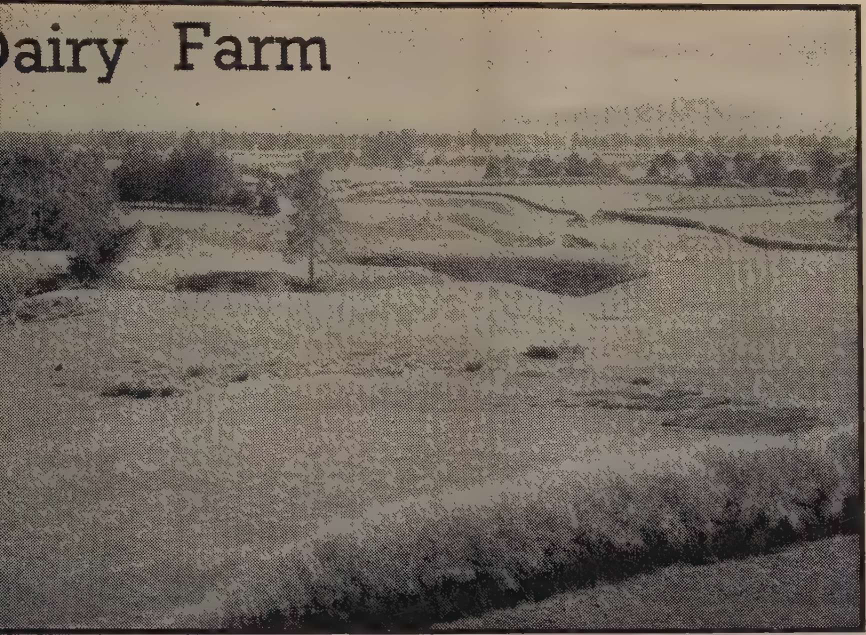
Soils

The soils are derived mainly from volcanic ash which fell in showers, forming huge deposits at the southern end of the county and eventually forming the low rolling country of that region. Tongues of wind-blown ash extended northward close to the Kaimai Range, and the Waikato River in its meanderings across the plain on its way to the Thames also carried ash northward. As the river's fall decreased on meeting the low-lying swamps near its outlet, the river deposited its ash sand and alluvium to form the Matamata Plain.

Around Matamata the soils are comprised of sandy and sandy silt loams. The farm chosen for this article is on the soil type Tirau sandy loam. The

Upper and lower illustrations: Contrast in development. Lower—Mangawhero Block as it appeared in 1904 from the present site of Mr. D. G. Seed's house. Upper—The same view in 1952.

Dairy Farm



soil is derived from the Tirau ash shower and although its profile varies considerably on the rolling country, it consists of:—

4in. to 5in. of brownish-black sandy loam over 8in. of free, brown sandy loam or slightly compact, brown sandy loam.

The soil is typical of a large area around Tirau and Okoroire and its very similar and neighbouring soil type Waihou sandy loam is typical of a large area around Matamata. These free-draining and easily workable soils do not pug during winter or spring, but have the tendency to dry out quickly in summer.

A Matamata Dairy Farm

In 1907 the Mangawhero Block, consisting of 7828 acres, part of the original Matamata Estate, was thrown open for selection. At that time portion of this block had been grassed and some shelter planted. The area of hill country included in the block, which was originally in heavy forest, had been felled in the early 1890's and had been sown to English grasses. Some of this had, however, reverted to scrub and fern, and in general the block was in the early stages of development. It was divided into 11 dairy farms varying from 174 to 359 acres, six other farms of from 694 to 1000 acres, and six suburban allotments of 3 acres each.

The block is now divided into 38 farms and the early photograph at the bottom of this and the opposite pages depicts the property in 1904. The recent photograph at left, taken from the same position, shows the advanced state of development that has occurred over the intervening years.

Portion of the original Mangawhero Block is owned by Mr. D. G. Seed, Taihoa, Matamata, and the recent photograph is taken from the present site of his house. The farm is located about 3½ miles from Matamata and ¼ mile from the main Hamilton - Matamata - Tauranga highway. The farm, of 169 acres, is larger than the average dairy farm in the district. Unlike the farms in the area which are flat or rolling and between 100ft. and 200ft. above sea level most of Mr. Seed's farm is over the 200ft. contour and about one-third of the farm is over the 300ft. contour. It forms a plateau which slopes away gradually to the north and south, but to the west and east drops steeply to the level of the river and road respectively.

Development of Property

The farm is a portion of 305 acres originally covered with manuka scrub when it was first settled in 1904. Since then all the farm that could be ploughed has been ploughed. Mr. Seed, senior, took over the 305-acre property in 1919 and it was farmed by him and his sons, Messrs. D. G. and L. Seed, as one unit until 1947. It was then divided and Mr. D. G. Seed obtained the 169 acres about which this article is written.

Subdivision and Water Supply

On a farm such as this subdivision is difficult. As far as possible fencing has followed the crest of the plateau and a central race leading from the cowshed gives ready access to all paddocks on the plateau. It has been necessary to install three cuttings down the sidlings to gain access to the paddocks adjoining the river.

Besides one or two small paddocks around the shed the farm has 21 paddocks ranging from 5 to 14 acres. Because of the topography, reticulation of water supply is difficult. All paddocks except two have water troughs. In these two paddocks the stock have access to the river, but are loath to drink from it.

Except for two clumps of gums, the farm is sheltered wholly by lawsonianas and barberry hedges. The road frontages, the surrounds of the house, and a part of one side of the race are planted in well-spaced lawsonianas. Practically all the other fencelines and all internal fences are planted with barberry. Barberry grows well in this area and makes an ideal shelter and windbreak. The hedges are trimmed well in their early years, but when they reach maturity the sides are cut in alternate years and topped occasionally, because, as Mr. Seed puts it, the hedges are grown for shelter.

Farm Management and Cropping

The farm carries 110 milking cows and all replacements and supplies whole milk to the local factory. Last

A view of the farm across the plateau. The Kaimai Range is in the background.

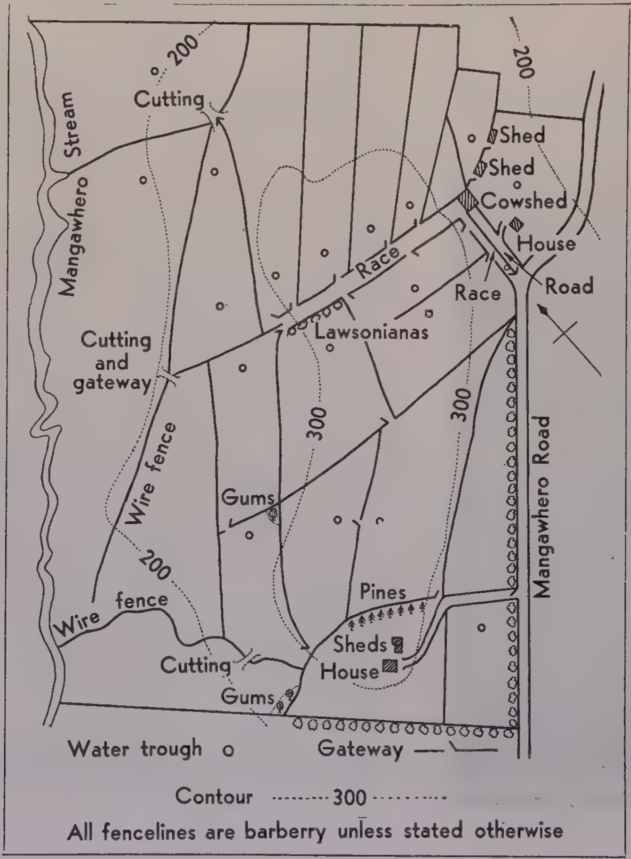
season no crops were grown, but until then a paddock had been ploughed every year for maize and chou moellier to provide summer feed for the milking cows and grassed that autumn. The land is cropped only once before grassing, because it quickly becomes weed infested. The land is usually ploughed in September and the chou moellier and maize sown in early and late October respectively to be ready for feeding off in January. The maize crops are cut and fed out, but the chou moellier is eaten in situ, the electric fence being used to divide the crop into daily breaks. After the crop has been eaten off, the area is ploughed and cultivated in readiness for the sowing of the permanent pasture in April. The pasture mixture is sown at the rate of 38 to 40lb. per acre and consists of:—

16 to 18lb. of Pedigree perennial ryegrass.

10lb. of short-rotation ryegrass.

4 to 6lb. of cocksfoot) and 2lb. of timothy or 2lb. of prairie grass.
1½lb. of white clover)
3lb. of cowgrass) and/or 2 to 5lb. of Montgomery red clover.

Some may consider the rate of seeding too heavy, but it has been found that this rate gives the best production in the early years of the life of the pasture and prevents the ingress of inferior pasture species. The newly sown pastures on the farm are much superior to the old ones. The productivity as a result of this sound policy has been raised until now the farm produces 40,000lb. of butterfat. Unfortunately part of the farm is too steep to be cultivated and the same policy of improvement cannot be followed there. The number of paddocks that can be ploughed is therefore strictly limited, and it has been necessary to plough up good pastures at times. However, the production of these new pastures has surpassed even those they supplanted.

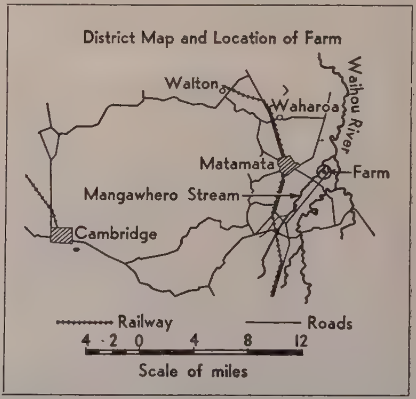


Pasture Management

The better pastures on the farm consist dominantly of perennial ryegrass, short-rotation ryegrass, and red and white clovers with some cocksfoot and traces of timothy and prairie grass. The unploughed pastures and sidlings consist of perennial ryegrass, paspalum, cocksfoot, and white clover. The pastures are managed in such a way as to supply an adequate and well-balanced diet for the milking herd as well as adequate reserves of autumn-saved pasture, hay, and silage.

About 100 acres of autumn-saved pasture are shut up each year. The herd and replacements are wintered entirely on the rest of the farm. The wintering is carried out on as small a number of paddocks as possible, but the paddocks are not allowed to be pugged too much. The farm is peculiar in that the hills and slopes pug up more quickly than the flats.

The cows begin calving in mid-July and are then turned on to the autumn-saved pasture, which is grazed as near as possible between 6in. to 8in. in height. The electric fence is used to ration the feed and the cows spend day and night in the same paddock. The pasture is not grazed too short (that is below 2in.) and with the high fertility of the pastures regrowth does not take long. It is usual to obtain two grazings from this autumn-saved pasture. In 1951 the autumn-saved pasture lasted 7½ weeks. By this time the normal spring growth is well on its way, so that there is never the shortage of feed at the end of September on this farm that occurs on far too many farms in the Waikato. A shortage results in a drop in production just as the cows are reaching their peak and causes a setback from which the herd does not fully recover. The dry cows may be used to clean up a paddock after the herd has eaten it out.



In spring the herd continues to graze each paddock rotationally and with grass 6in. to 8in. high the cows require ¾ to 1 acre each 24 hours. The electric fence is shifted after each milking and it is an essential part of the management. It is kept in constant use right up until harvesting time and after this period it is used in the larger paddocks. No separate day and night paddocks are employed, each field in turn being grazed day and night until all the feed is consumed, thus preventing the accumulation of fertility in some fields at the expense of others. The pastures are harrowed after each grazing until harvesting and also occasionally later in the season. Topping is done if necessary. The paddocks that have been ploughed of recent years have been oversown with 5lb. of short-rotation ryegrass in autumn and this grass has become well established and forms a good percentage of pasture cover. Rotational grazing with the electric fence and use of the harrows and mower keep the pastures free of any rank growth and result in a well-balanced, even pasture. Approximately a 14-day rotation is kept between paddocks and as soon as growth gets ahead of this rotation paddocks are taken out of the rotation and shut up for silage.

Silage and Hay

About 45 to 50 acres of silage are harvested each year and stored in pits or stacks. As the paddocks are shut up in rotation, they can be harvested in rotation at the correct stage. About 20 acres are harvested for hay each year, but because of the exceptional growth last season, 30 acres were harvested. The hay is baled by contract.

Manuring and Liming

Four or 5cwt. of phosphatic fertiliser in the form of serpentine superphosphate is applied each year, usually split into two dressings, in spring and autumn. All the farm is topdressed in autumn and the paddocks that were shut up for autumn-saved pasture and those that had silage harvested from them receive a dressing after those crops of grass have been eaten off and harvested respectively. Because of the nature of the farm, some paddocks that were shut up for autumn-saved pasture are again shut up for hay or a crop of silage, and a hay crop may be taken from the one paddock in a season. These paddocks would then receive an extra dressing of phosphate and/or receive a good wintering the following year to counteract the effects of that treatment. Two paddocks this season were cut for silage and then harvested for hay, producing 80 and 110 bales of hay to the acre respectively, showing the high state of fertility of the paddocks.

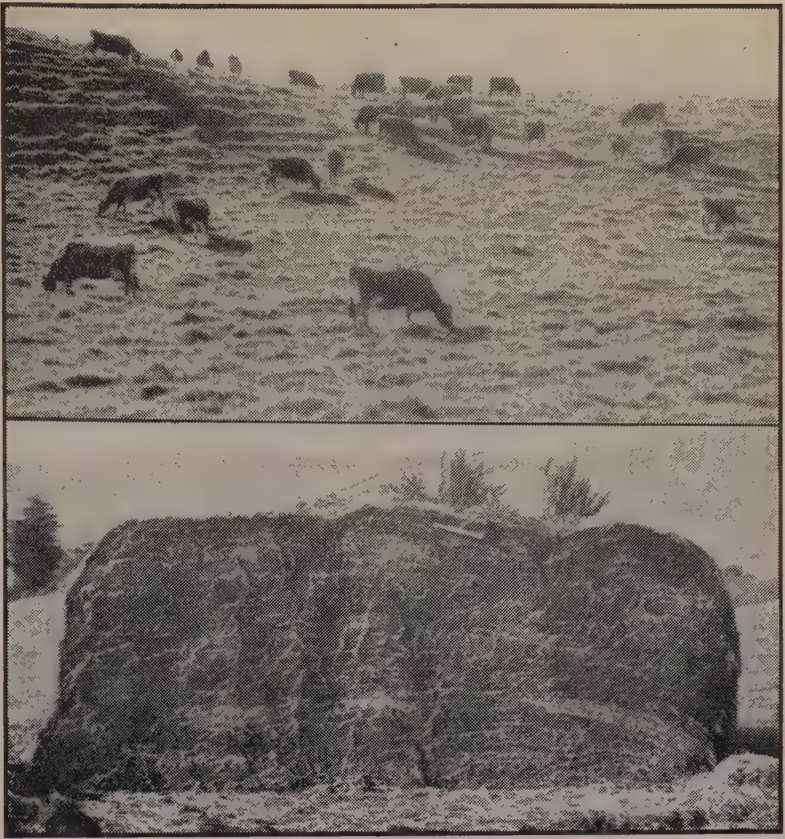
Lime is applied every second or third year in amounts that ensure that each paddock receives 3cwt. per acre per year. The manure from the shed is also utilised and the dressings are concentrated on a paddock a year. In company with most sandy soils in the Waikato that on the farm is responding to applications of potash. Some paddocks have received 1cwt. per acre and others have received potassic serpentine superphosphate. The following table gives the result of a soil analysis on three paddocks:—

	pH	Calcium	Phosphate	Potash
1	6.3	9	9.4 (med. high)	Medium
2	6.4	10	22.4 (v. high)	V. high
3	6.5	10	23.8 (v. high)	Medium

The high level of fertility as evidenced by the pasture growth is reflected in the soil analysis results. From the analysis it has been ascertained that ¾cwt. of phosphate per acre per year will maintain the high level of phosphate and that many of the paddocks, particularly those that have been harvested for hay and silage, would respond to larger dressings of potash. The paddocks that have been harvested most receive 1cwt. per acre initially, and all paddocks an annual maintenance dressing of 50lb. of potash.

Herd Management and Production

Since 1947 a herd of 110 grade and pedigree Jersey cows have been carried and have yielded the following butterfat on factory returns:—



Upper—The herd grazing on a break of autumn-saved pasture. Lower—Well-made stacks such as this with little waste produce good-quality silage for supplementary feed.

Year	Cows No.	Butterfat lb.
1947-48	110	34,000
1948-49	110	36,000
1949-50	110	34,000
1950-51	109	40,200
1951-52	110	39,500

The equivalent of nearly 2000lb. of butterfat is estimated to be used in feeding the 25 calves and supplying two households during the season. If this amount is allowed for, the production in the 1950-51 season amounts to 387lb. of butterfat per cow and 250lb. of butterfat per acre.

The high production per cow and per acre for this type of farm is the result of a herd bred from good cows and the best of bulls being well managed and efficiently milked and adequately fed all the year round on the best of pastures, hay, silage, and supplementary fodder crops in the dry summer.

Labour and Equipment

The labour force consists of the owner and a permanent hand who, except for the harvesting period, do all the farm work and milk the herd, using eight sets of cups. From November to March one or two agricultural students are employed to help mainly with the harvesting. The farm implements consist of two tractors, the usual complement of cultivating and harvesting gear, and a liquid manure trailer.

Summary

Production this last season would have been higher except that the herd suffered from bloat during certain periods and some of the pastures were affected with grass-grub. However, with the feed available and ample reserves of hay and silage on hand, Mr. Seed estimates he will be able to milk 120 cows this year and so the high production already obtained can and will be further improved.

If the size of the farm and its topographical features are considered, the production obtained is exceptionally good. Its attainment is due to:—

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2. A constantly tested, efficiently milked, and well-bred herd.
3. Well-sheltered and watered paddocks.
4. Full utilisation of existing pasture by the use of the electric fence.
5. Good grazing management together with the use of the harrows and mower where necessary and the shutting up of paddocks for silage as soon as the spring growth gets ahead of the rotation.
6. The management of each paddock individually and the farm as a whole adjusted to the climate and season.

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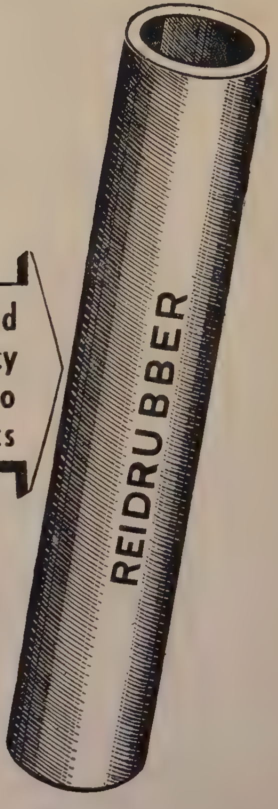

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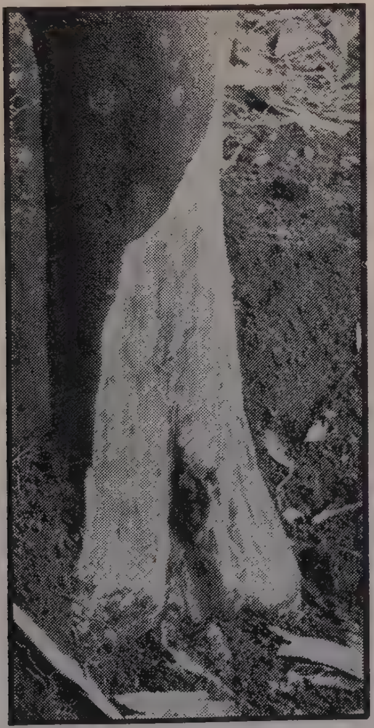
Collar Rot and Brown Rot of Citrus

SOME of the most destructive diseases of citrus are those found on the trunks, main limbs, and roots. Attack on these parts, especially the roots, is most likely to kill the whole tree, so prevention and successful treatment of trunk and root diseases are of the greatest importance. Collar rot, one of the most destructive of citrus diseases, and brown rot, a disease that causes considerable loss of fruit and leaves, are both caused by the same or closely related species of fungi, so that similar conditions favour the spread of both diseases.

THIS article by H. A. Prew, Horticultural Instructor, Department of Agriculture, Auckland, advises growers how to recognise the symptoms and apply preventive measures in the early stages of the development of these two diseases, when such measures are most likely to be effective.

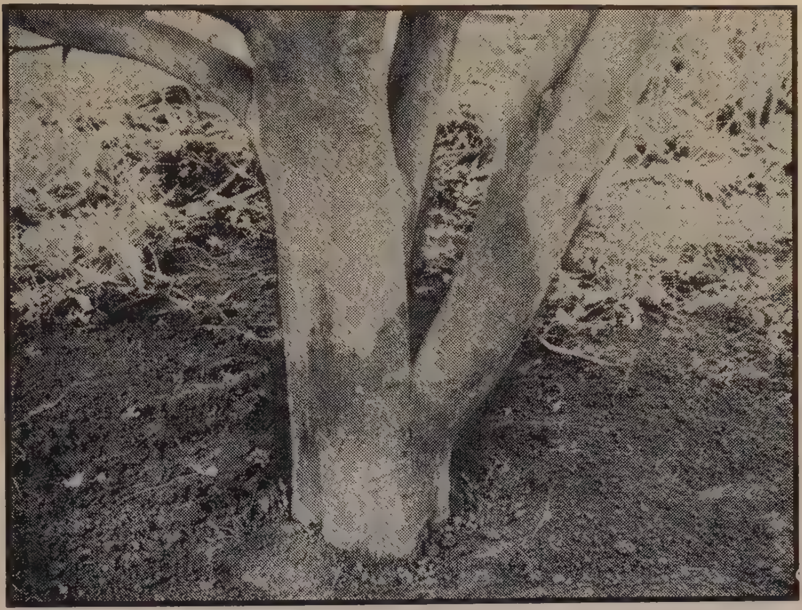
Collar Rot

Collar rot occurs in nearly every citrus district in the world, and in New Zealand it has been responsible for the destruction of many trees and is a major factor in limiting the production of citrus fruits. Collar rot can be caused by any of several species of *Phytophthora*. When the disease occurs below ground it is called root rot.



[*Sparrow Industrial Pictures Ltd. photo.*

Treatment for collar rot includes the removal of all infected bark and of healthy bark to at least ½in. beyond the affected area.



[*Sparrow Industrial Pictures Ltd. photo.*

The discoloured, dead area caused by collar rot is clearly shown. Early inspection and treatment would have prevented such an extensive infection.

Susceptibility of Varieties

All types and varieties of citrus are susceptible and may become infected to varying degrees under conditions favourable for the disease. Standard lemon varieties such as Eureka and Lisbon growing on their own roots are most susceptible. Island Seedling Sweet Orange, the main species used as a rootstock in New Zealand, and the rough lemon are less susceptible, and the only stock used extensively in New Zealand which appears to be highly resistant is *Poncirus trifoliata.*

Symptoms of the Disease

Symptoms of the disease are:—

There is usually a noticeable thinning of the foliage on the top of the tree with an almost complete failure to produce vigorous new growth.

As the disease progresses the leaves turn yellow and the twigs die back.

The tree may die quickly or may make periodic recoveries when weather and soil conditions are favourable.

The trunk (see illustration above) and main roots are usually affected. There is a dark area of discoloured dead bark that remains firm for some time after infection. Later this bark tends to dry and shrink, causing a longitudinal cracking. Frequently, there are exudations of gum from the diseased area and these will be greater in humid weather. Gumming is often the first sign of the disease. When the dead bark is removed a marked brown staining of a thin layer of wood is revealed immediately beneath.

Factors Influencing Disease

The disease is influenced by the following:—

Deep planting: The nursery practice of budding citrus trees gives growers some choice of rootstocks which are more resistant than the scions to collar rot, but the choice is restricted by such factors as compatibility between stock and scion, climate, and soil conditions. Unfortunately the point of union between stock and scion is a weak spot subject to infection by fungous diseases such as collar rot. To give maximum protection from these diseases, therefore, the susceptible bud union should be kept well above soil level and on no account should trees be set out in the orchard deeper than they were in the nursery. A good plan is to plant trees on mounds 2 to 3in. above the general soil level. The mounds will settle as the soil in the plant hole consolidates, and the trees will then be at a suitable depth. The first main roots at the base of the tree should never be more than 1 to 2in. below the surface of the soil.

Poor drainage: A necessary condition for the growth of collar rot fungi is abundant moisture in the soil close to the bark. When soil and air temperatures are suitable and there is abundant moisture, conditions are excellent for the development of the disease. It is therefore essential that the soil should be properly drained. Tile drains and mole drains are useful for removing excess water, but any type of drain, whether of wood, manuka, or scoria, that will keep the soil from becoming waterlogged could be tried. Open drains are very effective, but are usually undesirable.

Where a citrus tree is planted in a heavier soil periodical soaking of the ground beneath the tree with Bordeaux mixture 3 : 4 : 50 (4oz. of bluestone and 5½oz. of hydrated lime

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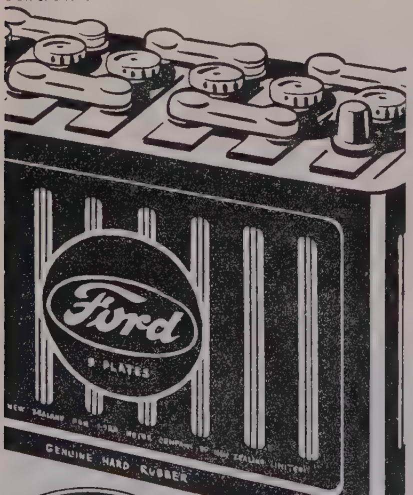
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to 4 gallons of water) and also applying this mixture to the trunk during spraying will be beneficial.

Faulty mulching: The practice of mulching ground under citrus trees with straw, lawn clippings, hay, or other suitable materials is excellent, as it improves the structure of the soil and, most important, it keeps the soil round citrus trees moist and cool during hot weather. However, mulches must be kept at least 1ft. away from the trunks of trees, because when mulch is allowed to lie against the trunks moist conditions which cause softening of the bark may occur and may create an ideal environment for the development of collar rot. For the same reason living weeds and grasses should be kept clear of the trunks.

Damage from cultivation: Cultivation must be shallow and must be done carefully to eliminate as far as possible injuries to trees. Although sufficient moisture and suitable temperatures are the most important factors influencing development of collar rot, the disease gains entry into the bark of the tree more readily through an injury than through sound bark.

Treatment

A great deal of damage caused by collar rot could be prevented by early treatment. It is suggested that growers should examine trees regularly and treat any diseased area immediately it is discovered. If treatment is done while lesions are small, there should be very little loss of production.

As soon as any signs of collar rot appear the following action should be taken:—

1. Remove sufficient soil to expose at least the first 6in. of the main roots.

2. Remove by cutting out and scraping all infected bark and wood from the trunk and roots, cutting back ½ to ¾in. into the healthy tissue to make sure that all infection is removed. This is the most important part of the treatment. This work can be carried out with a sharp chisel, gouge, or heavy knife.

[*Sparrow Industrial Pictures Ltd. photo.*

Failure to treat collar rot has resulted in the death of this tree.

3. Dress the wound with either acidulated mercuric chloride or Bordeaux paste. (Acidulated mercuric chloride is made by dissolving 1 gm. of mercuric chloride (about 1/28oz.) in 15 c.c. (about ½ fl. oz.) of concentrated hydrochloric acid and adding the mixture to 1000 c.c. (1¾ pints) of water. The mixture is poisonous and also rapidly corrodes metal. It should be kept in a glass bottle marked **Poison**. Bordeaux paste is made by mixing 1oz. of bluestone and 2oz. of hydrated lime with sufficient water to make a paste.

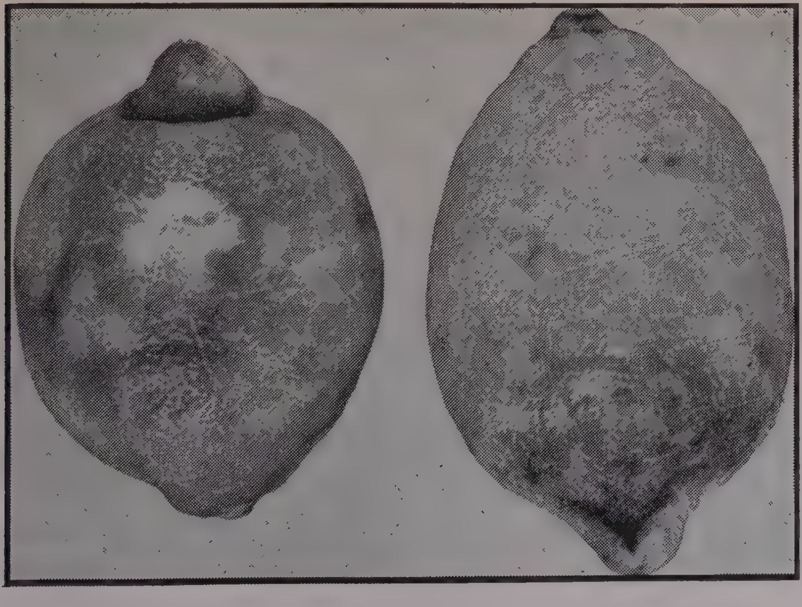
4. Leave the trunk and crown roots exposed for several weeks until the affected parts have thoroughly dried out. The hole around the base of the tree must be drained to prevent an accumulation of water, which would aggravate the trouble.

5. When the treated area is thoroughly dry brush off any surplus Bordeaux paste or dirt, cover the wound carefully with bituminous paint, and replace the soil.

If the bark has rotted more than half-way round the trunk, it is seldom worth while trying to save the tree. The wound would take a long time to heal and there would not be enough sound bark left to keep the tree vigorous and productive.

Brown Rot

Brown rot of citrus fruits is caused by any one of several species of *Phytophthora*, some of which also cause collar rot. Though the disease is prevalent throughout New Zealand citrus areas, it may not attack the trees every season, but in a season when conditions favour its development the disease can reappear with



Lemons infected with brown rot.

devastating effect on fruit and foliage. However, the disease is readily controlled by applying preventive sprays.

Conditions Leading to Spread

Citrus brown rot is caused by soil-borne fungi; in the orchard the spores of the disease may be splashed by rain from the soil to low-hanging fruit, twigs, and leaves and it is possible for these parts all to be affected at the same time. From the lower parts of the tree the spores are carried higher in splashes of water that are flicked by wind from the smaller twigs.

The fungus multiplies rapidly from infected fruit that has fallen to the ground and under suitable conditions the disease may build up to epidemic proportions from this source.

Ideal conditions for infection and rapid development are excessive moisture over considerable periods with cool to moderate temperatures. Such conditions are often experienced in New Zealand during May to August. The total amount of rain is not as important as the length of the wet periods. In a dry season very little trouble from the disease is experienced, but if no precautions are taken when weather conditions are favourable for the fungus, infection can spread through trees in a very short time.

Symptoms

Although infection is often not noticed until fruit falls prematurely, the first indications that the disease is present are brown patches on some of the leaves and rot appearing on the fruit. The rot is easily recognised—affected parts of the fruit are firm, pale brown, and have a distinctive, pungent, sour smell. There is at first only a slight discoloration on the surface of the fruit, but it extends rapidly from a centre of infection. There are other forms of rot that leave the fruit somewhat firm, but no other has the strong smell characteristic of brown rot. Leaves tend to fall to the ground while still green, trees may become partially defoliated, and twigs also may be killed.

Control

Control is not difficult, as the spores of brown rot fungus are particularly sensitive to Bordeaux mixture. A 3 : 4 : 50 Bordeaux mixture applied at the end of May or the first week in June is recommended and often is the only application required. If brown rot infection has been particularly severe in previous years or if conditions favour development of the fungi, a further application of the same spray mixture 4 to 5 weeks later will probably be necessary.

When signs of brown rot infection appear on trees later in winter or in early spring an extra spray should be applied immediately. Sprays should be applied at first sign of the disease, because its development can be very rapid and a delay of even a few days may render control measures ineffective.

Low branches should be pruned so that they are at least 18in. above soil level. Orchard hygiene is most important. All infected fruit should be removed and destroyed immediately.

Radio Broadcasts to Farmers

RADIO broadcasts to farmers will be given during June as follows:—

1YA Auckland, 7.15 p.m.

3 June—"The Care of Sheepskins", by D. G. Austin, Sheep and Wool Instructor, Department of Agriculture, Auckland.

10 June—"Winter Feeding of Stock", by C. M. Blick, Fields Instructor, Department of Agriculture, Warkworth.

17 June—"Poultry Topics", by S. G. Haddon, Poultry Instructor, Department of Agriculture, Auckland.

24 June—Y.F.C. session, by Northern Wairoa district committee of the Federation of Young Farmers' Clubs.

1XH Hamilton, 12.33 p.m.

4 June—"Tuberculosis in Cattle", by D. W. Caldwell, Veterinarian, Department of Agriculture, Hamilton.

11 June—"Drainage", by H. M. Bull, Instructor in Agriculture, Department of Agriculture, Hamilton.

18 June—"Wool", by L. Wilson, Federated Farmers, Hamilton.

25 June—"Pruning", by C. E. K. Fuller, Horticultural Instructor, Department of Agriculture, Hamilton.

1YZ Rotorua, 7.15 p.m.

11 June—"Winter Work in the Home Orchard", by F. L. Bailey, Horticultural Instructor, Department of Agriculture, Tauranga.

25 June—"Maintenance of Plant in the Milking Shed", by A. T. Gabolinscy, Special Inspector, Department of Agriculture, Tauranga.

2ZA Palmerston North, 12.33 p.m.

6 June—"The Progress of Tuberculosis Eradication in the Palmerston North Veterinary District", by J. J. Byrne, Veterinarian, Department of Agriculture, Palmerston North.

8 June—"Aerial Topdressing and Clover Seeding of Hill Country", by J. M. Hopkins, Instructor in Agriculture, Department of Agriculture, Levin.

15 June—"Why Prune Fruit Trees?", by B. P. Coleman, Horticultural Instructor, Department of Agriculture, Palmerston North.

22 June—"Maintenance of Equipment in the Milking Shed", by M. J. McFetridge, Special Inspector, Department of Agriculture, Palmerston North.

29 June—Y.F.C. session, by I. G. Tabor.

3YA Christchurch

8 June (12.20 p.m.)—Y.F.C. group discussion, by members of Christchurch district committee of Federation of Young Farmers' Clubs.

18 June (12.33 p.m.)—Review of "The New Zealand Journal of Agriculture", by E. G. Smith, Fields Instructor, Department of Agriculture, Rangiora.

25 June (12.33 p.m.)—"New Zealand Seeds in Britain", by W. Hadfield, Agronomist, Department of Agriculture, Christchurch.

4YA Dunedin, 9.15 p.m.

3 June—"Copper and its Relation to the Health of Livestock", by I. M. Cairney, Veterinarian, Department of Agriculture, Dunedin.

17 June—"Land Development in South Otago"', by J. G. Richards, Instructor in Agriculture, Department of Agriculture, Balclutha.

Regular Sessions

1XH Hamilton, Tuesdays at 8 p.m. (Frankton stock market report), Wednesdays at 12.33 p.m. (Report from Ruakura Animal Research Station), Thursdays at 12.33 p.m., Fridays at 8 p.m. (Waikato stock review).

1XN Whangarei, Mondays at 8 p.m., Wednesdays at 8 p.m. (Northland stock market report), Fridays at 8 p.m.

1YA Auckland, Mondays at 7 p.m. (Auckland stock market report), Tuesdays at 12.35 p.m., Wednesdays at 7 p.m., Thursdays at 12.33 p.m.

1YD Auckland, Thursdays at 7.30 p.m.

1YZ Rotorua, Mondays at 12.33 p.m. (Waikato stock review), fortnightly on Tuesdays at 12.33 p.m. (Federated Farmers' session), Tuesdays at 6.55 p.m. (Frankton stock market report). Thursdays at 12.33 p.m., Thursdays at 7.15 p.m. (farm talks alternating with session for Bay of Plenty farmers), fortnightly on Fridays at 12.33 p.m. (pig council talk).

2XA Wanganui, Wednesdays at 8 p.m. (Wanganui stock sale report), Thursdays at 8 p.m.

2XG Gisborne, Tuesdays at 8 p.m.

2XN Nelson, Thursdays at 8 p.m.

2XP New Plymouth, Thursdays at 8 p.m. (stock review).

2YA Wellington, Mondays at 7.15 p.m., Thursdays at 12.33 p.m., Fridays at 7 p.m. (Feilding stock market report).

2YZ Napier, Tuesdays at 12.33 p.m. (Hawkes Bay orchardist session), Tuesdays at 7.10 p.m., Wednesdays at 7.15 p.m. (Hawkes Bay-Poverty Bay livestock market report), Thursdays at 12.33 p.m.

2ZA Palmerston North, Mondays at 12.33 p.m., Fridays at 8.45 p.m. (Feilding stock market report).

3XC Timaru, Tuesdays at 8 p.m., Thursdays at 8 p.m.

3YA Christchurch, Mondays at 12.20 p.m., Wednesdays at 7.15 p.m. (Addington stock market report), Thursdays at 12.33 p.m.

3YZ Greymouth, Thursdays at 12.33 p.m.

4YA Dunedin, Wednesdays at 7.20 p.m., Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.33 p.m. and 7.15 p.m., Tuesdays at 7.15 p.m. (Lorneville stock market report), Thursdays at 12.33 p.m.

Book Review

"Home Doctoring of Animals": H. Leeney

THIS is an excellent general book for all who handle farm stock, including dogs and poultry. Though written for British conditions, it can be recommended to New Zealand farmers. The book is now in its fifth edition, and has been revised by C. Greatley Saunders.

It is obviously desirable that stock farmers should have a thorough knowledge of the treatment of stock diseases and injuries, particularly emergency treatment. Such information is available in readily accessible form in this book.

The subject is treated in a very practical manner. An example of this treatment, from page 77 of the book, is ". . . but it is nothing short of criminal folly for a man who keeps horses to be without a gripe (colic) draught or the materials from which he knows how to concoct one." Another, from page 102, reads ". . . the timorous man with a fear of blood is less likely to get himself into trouble than he who with the boldness of ignorance is ever ready to 'knife' his own or his neighbour's cattle."

Though foot-rot is not discussed to the extent that its importance in this country would warrant, the chapters on parturition and associated conditions, with illustrations and advice on the administration of medicines and the control of farm animals, are particularly helpful. The book also contains some good material on the dosages of different drugs and includes some useful prescriptions.

—*A.D.M.G.L.*

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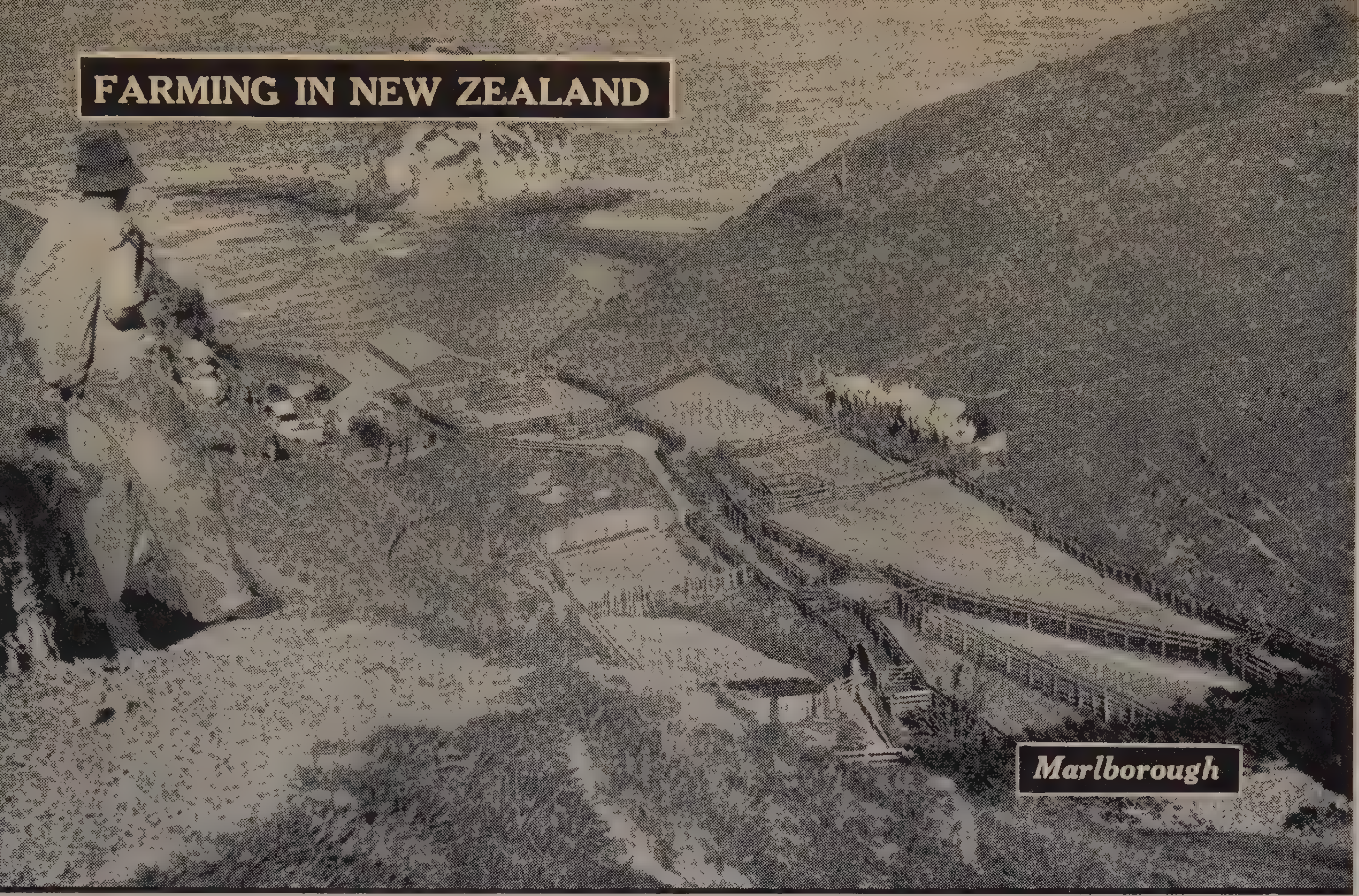
FARMING IN NEW ZEALAND

Marlborough



THE farming history of Marlborough Province and descriptions of the area's topography, rainfall, and various soil types, with details of present farming practices in some districts, were given in the first part of this article in the April issue of the "Journal". In this issue J. P. Beggs, Instructor in Agriculture, Department of Agriculture, Blenheim, describes other district farming practices and concludes with a section on the Sounds area, which, because of its access problems and hilly terrain, requires special consideration.

AT the conclusion of the first part of the article, under the heading "Types of Farming", the distribution of various types of farming throughout the province was described. This subject is continued here.

Types of Farming

Cash Cropping on Mixed Farms

Peas are the most important arable crop in Marlborough, and in the lower Wairau Valley their growing is more concentrated than in any other part of the Dominion. In 1949-50 the area grown was 7974 acres and the average yield was just over 27 bushels per acre.

The main localities where this crop is grown are the lower Wairau Valley and Seddon. Peas are grown at various points in the rotation and sometimes successive crops are taken in the same paddock, but because of disease and weeds this latter practice cannot be recommended. Best results and most consistent yields are secured when peas are taken as the first crop after grass.

Varieties grown are mainly William Massey, Greenfeast, and Onward in the garden group, and Prussian Blue in the field type. However, numerous other varieties such as Little Marvel, Yorkshire Hero, Stratagem, and Witham Wonder are important. Other varieties bearing only an identification number are commonly grown in the district on contract to mercantile firms who have undertaken multiplication on behalf of English firms. Most pea crops grown in the district are on a contract basis with mercantile firms.

Crops are normally sown with the ordinary grain drill in 7in. rows, though contract areas of "stock" peas, which are grown annually by the different firms to maintain pure seed stocks, are sown in 21in. rows and intercultivated. Rogueing gangs, working on behalf of the firms, inspect and rogue both commercial and stock areas, with the result that a high standard of quality is maintained.

Field peas (Prussian Blue) are grown mainly on the lighter, drier soil types, the Fairhall, Omaka, Rapaura, and Seddon districts producing a large percentage of this type. These crops are commonly sown in autumn (usually in May). Garden varieties, on the other hand, are normally spring sown (September and October) and are grown predominantly on the better-class land, such as the Blenheim, Spring Creek, Tuamarina, and Grovetown localities, though they extend on to a wider variety of soil types than do field peas.

The usual method of harvesting is to cut with the mower and thresh with the pick-up header harvester, though in some areas the crops are direct headed, particularly where there is a danger of high winds blowing crops after cutting.

Wheat: In recent years the Marlborough acreage of wheat has been between 4000 and 5000. In 1942-43 the 11,000-acre mark was passed.

Though yields of 60 bushels per acre are normally expected on the best plains wheat land, the average yield for the district is approximately 35 bushels per acre. Most of the wheat is of the Cross 7 variety; Jumbuck is also quite common, but its popularity has waned in recent years. Other varieties are Hilgendorf, Fife Tuscan, and Dreadnought.

Autumn sowing is common, but a proportion of spring sowing takes place each year, often as a result of wet winter conditions preventing earlier sowing.

The most common place in the rotation for wheat is after peas or rape.

HEADING PHOTOGRAPH: Practically all of the Marlborough Sounds country is hilly and on many properties little flat land remains after the erection of the homestead and sheepyards.

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Barley: Next to wheat, barley is the most important cereal crop grown in Marlborough, the annual area being much the same as for wheat. Most barley grown is of the malting varieties, though the feed varieties Cape and Black Skinless are of some importance.

In the past barley grown in Marlborough was known for its good malting quality, the sunny climate no doubt playing an important part in this respect. In recent years this reputation was lost, owing to the increasing popularity of the variety Pryor, which, though an excellent yielder, is not of high malting quality. More recently, however, as a result of experiments carried out with new varieties there has been a very pronounced swing away from the growing of Pryor and toward Kenia and Research. This trend should go a long way toward restoring the reputation of the district as a producer of high-quality barley.

Nearly all malting barley is spring sown, the small amount of autumn sowing taking place on the lighter, drier land. The average annual yield of barley is higher than that of wheat by approximately 5 bushels per acre. Crops of over 100 bushels per acre are secured occasionally on the fertile land of the Wairau Valley.

Oats are not a very important grain crop in the district. They are grown widely for greenfeed, with grain production as a secondary consideration. The Algerian variety is the main one used in this way. A smaller area of white oats such as Onward and Abundance is grown for milling. Nearly all sowing of oats is done in autumn.

The annual area of oats for threshing is usually about 1000 acres. As grazing often interferes with grain production, the average yield is very low, being about 27 bushels per acre.

The area of oats grown for chaff was approximately 15,000 acres a year in the 1920s, but about 2000 acres a year are now grown for this purpose.

Cowgrass is the most important small seeds crop in Marlborough, and the province is well known for the high yields and the good quality of seed produced. Yields of about 1000lb. of machine-dressed seed per acre have been secured. This is certainly exceptional, but every year a few paddocks in the more favoured areas yield more than 700lb. of seed per acre. Best yields are obtained in areas bordered by hill country, such as the Kaituna Valley.

Sowing practices for this crop vary and include sowing with rape in spring, sowing under cover of a cereal in either autumn or spring, and sowing in a pasture mixture in autumn. However, in all instances suitable treatment with lime and phosphate is important for good results.

Hay is normally cut during November, and the area is then left for the seed crop. Limited controlled grazing is also secured from cowgrass seed areas on many farms, but heavy grazing is carefully avoided. Normally two, and sometimes three, payable crops of seed are secured, but areas are seldom left down for more than 3 years.

Cowgrass, in producing both hay and seed over a period of 2 to 3 years, is a crop that fits in well with the rotation on cropping farms. For this reason it is grown predominantly in Marlborough County. The area grown for seed in 1949-50 over the whole district was 4186 acres, more than 95 per cent. of this area being in Marlborough County.

Perennial ryegrass: Small areas of Italian and short-rotation ryegrass are saved for seed annually, but perennial ryegrass is the most important grass seed harvested. Over the past 10 years the area closed for seed production has averaged 850 acres. The crop is concentrated in the Wairau Valley near Blenheim and Spring Creek, though areas are harvested in almost all parts of the district where agricultural farming is carried on.

Good yields are normally assured on the better-class land of the plains, and owing to the dry summers and the high incidence of sunshine the seed is usually of excellent quality. The conditions mentioned usually result in low incidence of blind seed disease.

Lucerne: Herbage and seed production from lucerne in Marlborough is particularly good. The main strain of lucerne now used in New Zealand was developed from selections made in this district and still bears the name of the province.

Lucerne is grown in Marlborough for three main purposes, for grazing, for hay, and for seed production, though the haying and seeding uses are always combined when seed is saved, one or two cuts of hay being taken before closing the area for seed.

The use of lucerne entirely as a grazing plant is confined to the light, dry-soil types of country, on which it is often combined with pasture species such as cocksfoot and subterranean clover. However, hay and seed areas are often used for restricted grazing at certain times of the year or in drought seasons when normal grazing areas fail to provide sufficient fodder.

In view of the suitability of the district for the growing of lucerne, it is surprising that the area grown is not larger; during recent years it has averaged 2500 acres.

White clover: The area of white clover harvested for seed in 1949-50 was 1000 acres, with an average yield of 171lb. per acre. The main producing

[Gordon McCusker Studios photo.

Threshing peas with header harvesters. Peas are the most important arable crop in Marlborough, and in the lower Wairau Valley their growing is more concentrated than in any other part of the Dominion. In 1949-50 the area grown was 7974 acres, which was 19 per cent. of the New Zealand acreage.

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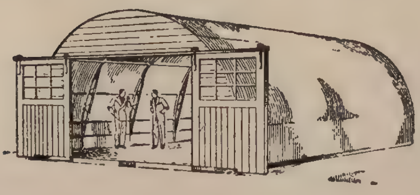

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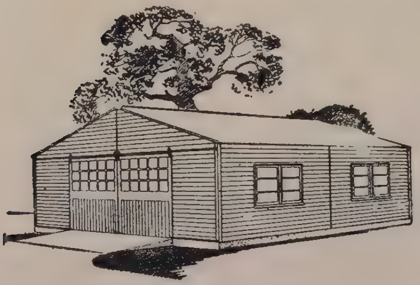

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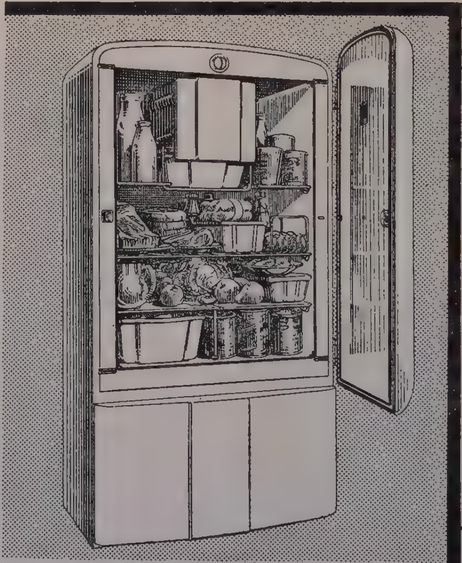

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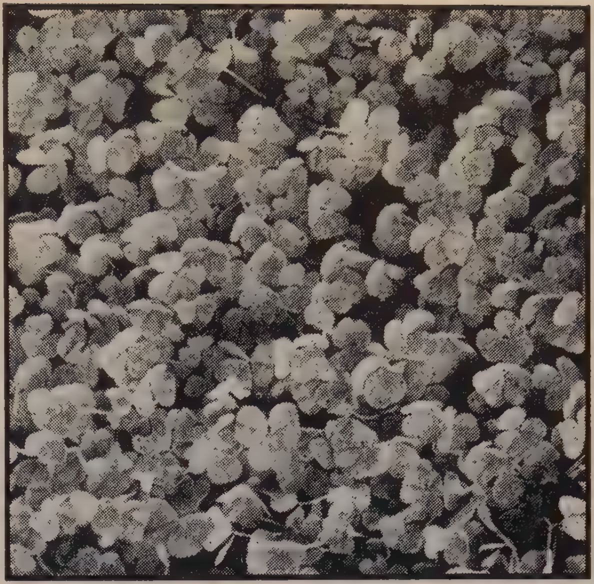

Subterranean clover grows well in Marlborough and this province is the Dominion's most important producer of seed for this crop.

area is the better-class land of the lower Wairau Valley, though the crop is grown to some extent in other parts of the province, depending largely on seasonal conditions. In the lower Wairau Valley it is farmed more as a cash crop than as a catch crop, and high yields are normally expected in this district.

Though three other land districts produce more white clover seed annually, Marlborough produces a higher yield per acre than any other area in the country.

Usually the clover is sown with ryegrass, the latter being harvested for seed in the first year and the clover in the second or subsequent years. In some areas, however, notably in the Spring Creek district, the clover is sown without grass and harvested for one seed crop. It is unusual to secure two good successive crops of seed from the same area.

The normal method of harvesting is to cut with a mower and thresh from the swath with a header harvester.

Subterranean clover: Marlborough is the Dominion's most important producer of subterranean clover seed, not only because the crop grows well in the district, but also because the climate is so suitable for harvesting of the seed. The latter factor is the more important, as it is essential that dry conditions prevail during late summer and early autumn if the seed is to be harvested before germination begins.

Subterranean clover seed areas are located mainly in the Fairhall and Wairau Valley areas, on soils of light to medium texture. Harvesting is easier if there are no stones in the surface layer of soil.

Seed may be harvested as a catch crop from areas sown to subterranean clover in many different ways, but the best and most consistent returns come from specialised seed areas. Such areas are normally sown early in autumn at a seeding rate varying between 10 and 18lb. per acre, with or without a cover crop of oats or barley.

Different methods for harvesting are in use, but the most popular is that using the stiff-tined hay rake. When dead ripe the crop is raked, without cutting, into windrows. Threshing may take place direct from the windrow with the header harvester or later from the stack with the clover huller.

Onions: Marlborough holds pride of place in the Dominion as the most important province in the production of onion seed. Practically all the commercial seed production of this crop in New Zealand is carried out near Blenheim.

Normally, crops are grown on contract to mercantile firms, though there is a limited amount of private growing. Bulbs for seeding are almost exclusively grown in the North Island, and are planted out in June and intercultivation and hand howing are done until the growth of seed heads prohibits this work.

Seed heads when mature are cut by hand and dried out on racks or on canvas sheets before being threshed with the header harvester.

Garden seeds: In addition to the main farm crops, smaller areas of seed

The high incidence of sunshine and suitable soil conditions make the area near Blenheim one of the best in the Dominion for the production of good-quality garden seeds. The illustration shows a crop of onion seed, most of the Dominion requirements of which are produced in Marlborough.

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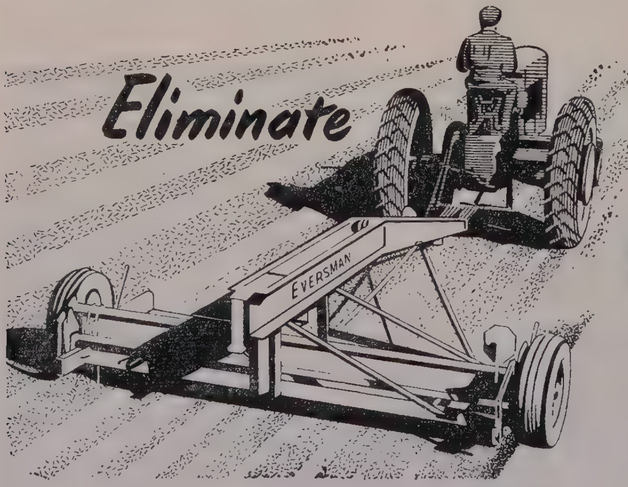

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[*V. C. Browne photo.*

Picton, at the head of Queen Charlotte Sound, is the port for the province, and meat freezing works are also situated there.

crops for garden seed production are grown in the lower Wairau Valley area, mainly near Blenheim, Grovetown, and Spring Creek.

The high incidence of sunshine and suitable soil conditions make this area second to none in the Dominion for the production of good yields of high-quality seed.

Nearly all of this type of seed is grown on contract to seed firms, and crops commonly involved are beans of all classes, peas, beetroot, silver beet, parsnips, onions, cabbages, and cauliflowers.

Dairying

Dairying on a commercial scale was established on the slow-draining flats of the Wairau Valley in 1893 and later at Kaikoura. In the following year 3365 milking dairy cows were recorded in the province. After 1910 numbers increased rapidly and reached a peak of 17,301 in 1934. A decline then set in, numbers falling in 1939 to 13,937 and remaining near this figure since then. An increase in dairy cow numbers has been recorded in Kaikoura County since 1946, but this has been offset by decreases in Awatere and Marlborough Counties.

The main centres of dairying at present are Rai Valley, Linkwater, Koromiko, Blenheim, Okaramio, and Kaikoura. The province is served by four cheese factories (Rai Valley, Linkwater, Tuamarina, and Koromiko) and two butter factories (Blenheim and Kaikoura). The Rai Valley factory, which is one of the largest cheese factories in the South Island, produced casein for one season, but has since reverted to cheese production.

Large herds are not common, there being only four herds of 100 or more cows.

Jerseys and Shorthorns are the most common breeds, and very frequently these two breeds are crossed to produce a cow useful both for milking and for beef production.

Hay for winter feeding is made largely from cowgrass stands, particularly in the Rai Valley, Linkwater, and Okaramio areas, where cowgrass seed production is normally associated with dairying. However, meadow hay is also commonly used and in some parts lucerne. The use of silage is very limited, but extension of its use would doubtless be beneficial. Turnips are commonly grown on dairy farms and on some farms maize is grown for greenfeed. The latter crop is a valuable one in the lower Wairau Valley, where dairying is normally adversely affected by dry summers. Some farmers in this area have recently installed private irrigation systems, results from which have been most gratifying.

Cropping Farms

There are a number of farms near Blenheim on which practically no stock are run, the main emphasis being on cropping.

The crops and the methods of handling them are much the same as those described for mixed farms. The most important crops are peas, barley, wheat, oats, cowgrass, and lucerne, and the rotation is adjusted to use the two last named to spell the land from the drain of cereal and pea production.

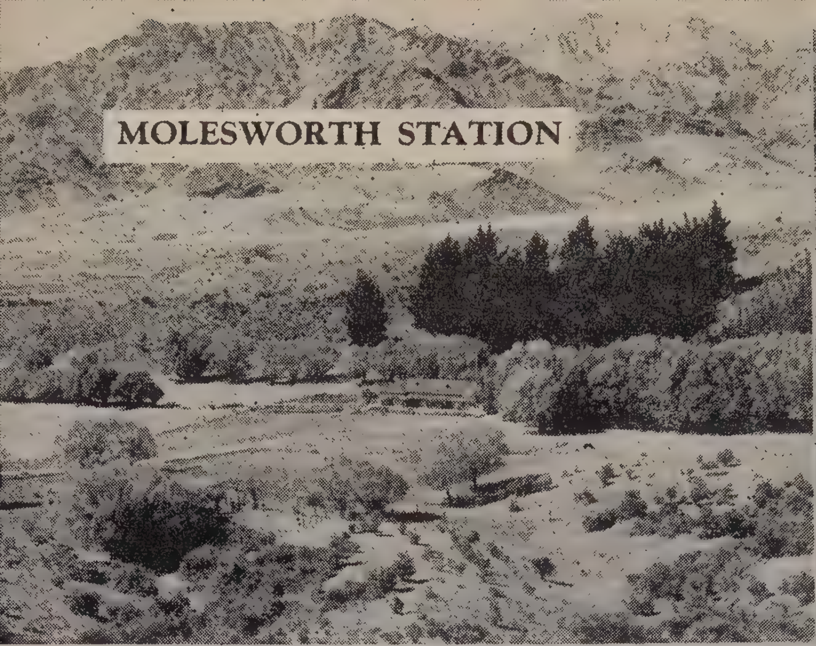
Though this type of cropping has been carried on for years on some properties, the recent high wool prices encouraged several farmers to change over to the mixed type of farming.

Cattle Runs

A system of farming of minor importance in Marlborough, though worthy of mention, as it has been adopted on the well-known Molesworth run, is that where beef cattle only are carried.

Though at one time Molesworth was a prosperous sheep run, difficulties in

MOLESWORTH STATION



The area of high hill country comprising Molesworth Station has been severely affected by erosion, and regeneration experiments are being carried out by the State. Upper left—The homestead on Molesworth. Upper right—Depleted country. Middle left—Part of Tarndale Station, which is now worked with Molesworth. Lower left—Part of Molesworth on the upper reaches of the Awatere River, showing the effect of damage by rabbits, intensive control of which (lower right) is part of the regeneration policy.

[*Photographs by National Publicity Studios.*

maintaining sheep numbers increased through the years, until ultimately the region was considered uneconomic for sheep farming, and the run reverted to the Crown. This failure of sheep farming was the result of several causes, chief among which were the rigours of the winter climate and the ravages of rabbits. These factors led to extreme denudation of much of the country, with erosion, and in severe winters stock losses were so great that there was difficulty in breeding replacement stock and maintaining the flock at a suitable level.

When the run reverted to the Crown it was decided to use it entirely for cattle breeding, and this has been done in recent years. Both Aberdeen Angus and Hereford cattle are run. Sales consist mainly of 2- and 3-year-old steers and cull cows. Practically all stock are sold as stores, though many are in good forward condition.

There is no road access from outside to farms in the Sounds and all transport is by water. All farm supplies are carried by launch (upper right) and stock are shipped out by punt (above).

In this region cattle have the advantage of withstanding the heavy snowfalls better than sheep and also of grazing less severely and thus leaving a better cover of pasture as a protection against erosion.

However, the rabbit still remains a problem, and until this pest is eliminated from the region, adequate returns cannot be expected from capital and labour invested in farming operations, and the rejuvenation of the country will be seriously impeded.

In the Canterbury Land District the large St. Helens and St. James runs, which are adjacent to Molesworth and are faced with similar conditions, have also recently changed over to cattle and are run under a similar system to that on Molesworth.

The Bluff station, which adjoins Molesworth on the northern side, is also faced with difficult climatic and rabbit problems. It has not been converted entirely to a cattle run, but cattle play a very important part in the management policy.

Orchards and Market Gardens

Records for the 1949-50 season show a total of 433 acres of registered bearing orchards in Marlborough County and only 28 acres of orchards in the other three counties in the province.

Of chief importance is the Rapaura district, where over 90 per cent. of the commercial orchards are located. Apples account for approximately 80 per cent. of the total production, the remainder being composed mainly of peaches.

Most market gardens are located on the fertile land near Blenheim. The total area used in this type of production in 1949-50 was 154 acres, of which Marlborough County accounted for 147 acres. The production of glasshouse tomatoes and market gardening generally are favoured by Blenheim's sunny climate, and given favourable marketing facilities these could well be expanded considerably.

Farming in the Sounds

Though much of the general information detailed in this article is applicable to farming in the Sounds area, it is desirable, in view of the unique position of this region in regard to transport and other facilities, to present an outline of its farming methods and problems.

Practically all the country in the Sounds is hilly. Though most of the hills are below 2000ft., a large proportion of the country is very steep. There are only a few small ploughable areas at the heads of bays and inlets, but little cultivation work is carried on and practically no crops are grown. Of an occupied area of 215,600 acres in Sounds County, only 7100 acres or 3.3 per cent. can be ploughed or disced.

The whole area may be regarded as sheep-breeding country, the Romney being the predominant breed. Sales are wool, cull and aged ewes, wethers, lambs, and some cattle. Most stock are sold in store condition, though some fat lambs are produced. The aged Romney ewes from this area are very suitable for fat lamb production on the Wairau Valley mixed farms.

Transport Problems

The almost complete absence of normal road transport facilities in the Marlborough Sounds is the most important factor in making the area unique for farming. There is no road access from outside, and only a small amount of internal roading. All transport is by launch or punt and mail launches normally make two trips per week to most parts for delivery of mail and bread and other stores.

Some settlers are fortunate in possessing suitable locations for a jetty; others in situations where a very long, expensive jetty would be required to reach deep water are forced to row out in a dinghy and meet the mail launch. Schooling is largely by correspondence for young children, to be followed by boarding school.

Transport costs are high. This makes fertilisers and lime and other goods expensive, and places an extra charge on livestock being delivered to markets, for sheep and cattle have to be transported to Picton or Havelock by punt and then railed or conveyed by road to their destinations. An exception to this is a small proportion of fat stock or boners punted direct to the freezing works at Picton.

Deterioration of Land

In common with much hill country in other parts, deterioration in carrying capacities has taken place in the Sounds area. In some instances whole properties have gone out of production. This has usually been the outcome of an unsuccessful fight against weeds, mainly fern and tauhinu. Southerly slopes have proved very difficult, and in many instances impossible, to maintain in economic production, and in the light of present knowledge it is apparent that most of the shady country would have been better left in its original bush cover. Some of this country is now reverting to bush. More may yet suffer the same fate, but much useful sheep country will still remain in the Sounds region, and some of it may be greatly improved.

From a figure of 196,000 sheep in 1920-21 the numbers declined to 149,000 in 1949-50 and during the same period cattle numbers dropped from 6900 to 6540.

Here, as in other parts of Marlborough, some of the decline in carrying capacity of the hill country must be regarded as a natural consequence of over-development in the early days. More, however, has been due to general pasture deterioration and consequent weed invasion (the two go hand in hand). When pastures are good and relatively high stock concentrations can be maintained and weed growth ceases to be a problem. The future of much of the Sounds country is undoubtedly tied up with this fact, for it would appear that the only real solution to the weed problem is in the improvement of pastures, rather than in a direct attack against the invaders.

Improvement Methods

The key to the improvement of pastures must lie largely in the surface sowing of good seed and correct fertilising, though increased subdivision and suitable stock management must naturally go hand in hand with any such improvement programme. In the relatively equable climate of the Sounds area, with its good rainfall, the response to some fertilisers is excellent. However, special problems arise in this area which make the application of fertilisers difficult and costly. First, high transport costs are a factor; second, present types of topdressing aircraft could have limited use only. Some farmers, however, have begun fertiliser application with blowers operated from ridges and bulldozed tracks.

That they consider this to be an economic proposition indicates that pasture responses are very pleasing, for the costs are very high. Certainly these progressive activities augur well for the future of the Sounds, for if this type of work can be economically extended over a large part of the farming land in the area, the increase in production will be great. The potential is there. It is a question of economic development. Probably much will depend on the prices of wool and fertiliser in the immediate future, though the recent discovery of molybdenum deficiency in the Sounds has already opened up new possibilities in the economic application of fertiliser in this region, where the transport and application of bulky materials present a major problem.

Prospects of Province

Except for small areas of flat river valleys and coastal plain, Marlborough is a district of hills and mountains and its future is largely dependent on the improvement of much of this country. The Sounds area with its higher rainfall has been faced with the problem of reversion to tauhinu and second growth and has been further handicapped by difficult access problems and associated high transport costs. Much of the hill and mountainous country to the south and west under lower rainfall conditions has had its native and tussock cover depleted by overburning and rabbits and some of this land which was held under Crown licence has reverted to the State and experiments are now being made in its regeneration.

Despite this deterioration and consequent decline in stock numbers on the hill and mountainous country it is physically possible to effect improvements over much of the area and the results achieved by some hill-country farmers are encouraging. Aerial sowing and topdressing, access tracks made by bulldozers, and the use of blowers for spreading fertiliser from ridges and tracks are some of the technical means available for improvement of hill pastures.

Experiments show that good responses are obtained from the use of fertilisers and lime on the hill areas, but in the past the task of applying fertilisers has been arduous and costly. With some of the technical problems being overcome, it is likely that there will be a considerable improvement of many hill-country pastures under good management practices.

The district is no longer handicapped by inadequate transport facilities with other parts of the Dominion. Rail connection with Canterbury has brought the Addington stock market within easy reach of the Marlborough farmer, and the intensive farmer such as the market gardener and fruit grower has an outlet to the Wellington market by air service.

There is little doubt that advantage will be taken of the means now available to increase production from the hill country, and the farmers of the district besides being noted as breeders of good sheep and producers of high-quality seed should in future be showing marked increases in the output of livestock products.

◆

Successful Use of Hormone Weedkillers

THE need for getting complete coverage of plants when using hormone weedkillers was proved recently by the experience of a farmer in the Te Puke district.

The farmer boom sprayed a patch of dense lupin 4ft. high on 21 July with the boom 24in. above ground level. The hormone used was the volatile ethyl ester of 2,4-D, mixed with water 1 in 90, and applied at the rate of 20 gallons per acre through 32 nozzles. Results were poor because of the poor spray coverage of the plants through the boom being too low.

On the same day the farmer spot sprayed lupins with the same mixture, thoroughly wetting the plants, and obtained a complete kill. Ten days later, spot spraying killed a patch of "old-man" lupins about 10ft. high. Two months later boom spraying was again attempted, this time with the boom lifted so that it cleared the lupins. The same hormone mixture was used as on 21 July and a far better coverage of the plants was obtained. These were completely distorted and a very good kill resulted.

—*A. V. ALLO,*
Instructor in Agriculture,
Department of Agriculture,
Tauranga

◆

Mole Drainage

ON any country where a stiff, impervious, clay subsoil prevents rain-water from passing freely down through the ground and the land therefore lies wet and cold for long periods in winter and spring, mole drainage is by far the cheapest and easiest and generally the most effective method of draining.

Though many farmers and contractors make a good and lasting job of mole drainage on such land by careful attention to detail and good practice, there are still far too many failures and partial failures. In good mole draining country mole drains should last from 10 to 20 years or more if carefully and properly put in, but far too often the life of the drains is only a few years, and often less. There are many and varied reasons for the failure of mole drains, and bad outlets are the most frequent.

Water cannot get away freely from mole drains if the outlets are not clean and always open. If the water lies in the moles for any length of time, the moles soon break down through softening of the clay or the accumulation of silt. If outlets are in an open paddock, they should be protected from stock, and if they are discharging into an open drain, they should end in a tile. Undoubtedly the best outlets are those where a number of mole drains are gathered to discharge into one drain channel, which is then tiled and properly covered. A slight increase in the fall in the moles to the outlet helps to keep it clear and open.

In many cases the moles do not end in the clay but pass through ironstone or soft soil to the outlet. This is a frequent and bad fault, since the moles will not hold in the loose soil. In such cases open drains should be cut back into the clay and the moles entered in the clay from this drain, which should be tiled and covered when the job is completed. Good, clean, well-protected outlets in solid, clay subsoil are essential for good mole drainage.

—*E. W. S. WILSON,*
Farm Drainage Officer,
Department of Agriculture,
Palmerston North

◆

Pruning Fruit Trees in the Home Orchard

PRUNING of fruit trees, though by no means the beginning and end of fruit production, is vitally important. Cultivation, spraying, and manuring are also important, and if the desired results are to be obtained, all cultural operations must receive adequate attention. A full understanding of pruning can only be gained through years of experience, but good results can be achieved if the pruner has some knowledge of the aims and general methods adopted. This article has been prepared by H. A. Prew, Horticultural Instructor, Department of Agriculture, Auckland, as a guide to pruning for inexperienced home gardeners. The tree parts referred to are shown in the illustration at the top of page 473.

A well-developed fruiting arm on a peach tree.

THE time to prune apple, pear, peach, plum, apricot, and cherry trees is when they are in the dormant stage. This is generally from May to the end of July, though the period extends into August for some of the late-moving fruits and in some of the colder districts. Citrus trees should be pruned in spring and early summer as soon as all danger from late frosts has passed.

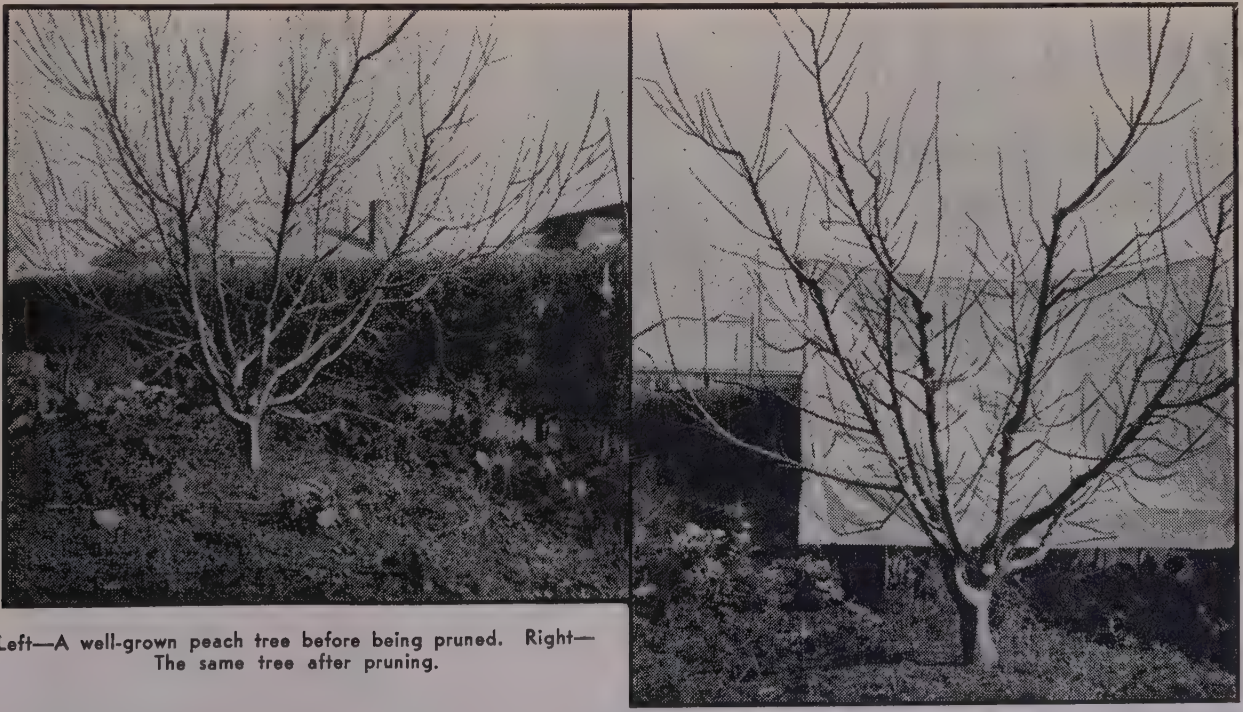
Summer pruning should be confined to the removal of interfering growths on young trees. Where the cutting out of large limbs on stone fruit trees becomes necessary this is best done in summer, as the cuts will heal more rapidly and there will be less danger of entry of silver leaf disease.

The tools required (secateurs, saw, and knife) should be kept sharp and clean. All wounds are possible points of entry for disease. Clean cuts heal quickly, and any rough cuts should be trimmed with a knife. A wound dressing such as a heavy crude petroleum jelly or bituminous paint should be applied to the larger cuts.

Objects of Pruning

The objects of pruning are briefly to develop a tree which is capable of regularly carrying heavy crops of high-quality, good-sized fruit over the normal productive life of the tree and which can be handled in the most convenient and economical manner.

To achieve this it is necessary to form a tree with a strong framework of 5 to 7 well-spaced leaders with fruiting arms rising from each. These are the permanent parts and upright, vigorous shoots should be selected for the development of the leaders. Where fruiting arms are to be formed shoots which are on the outside of the leaders and which are growing outward at an angle of approximately 45 degrees should be selected. The framework



Left—A well-grown peach tree before being pruned. Right—The same tree after pruning.

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Mammitis

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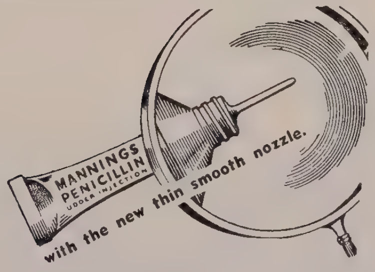

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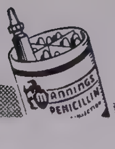

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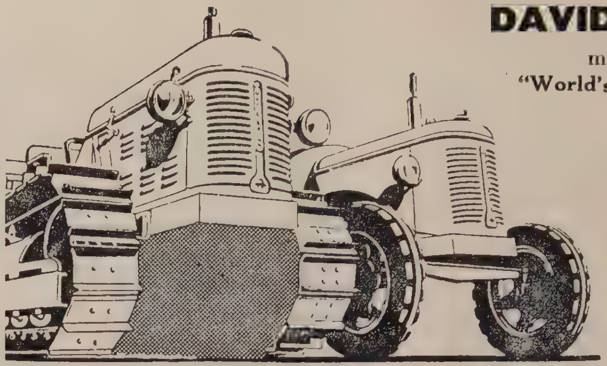

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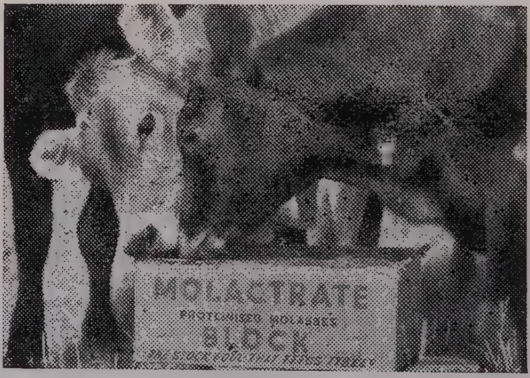

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should be furnished throughout with fruiting wood, which constitutes the temporary parts of the tree, and this wood should be replaced as it becomes worn out. All dead and diseased wood should be removed.

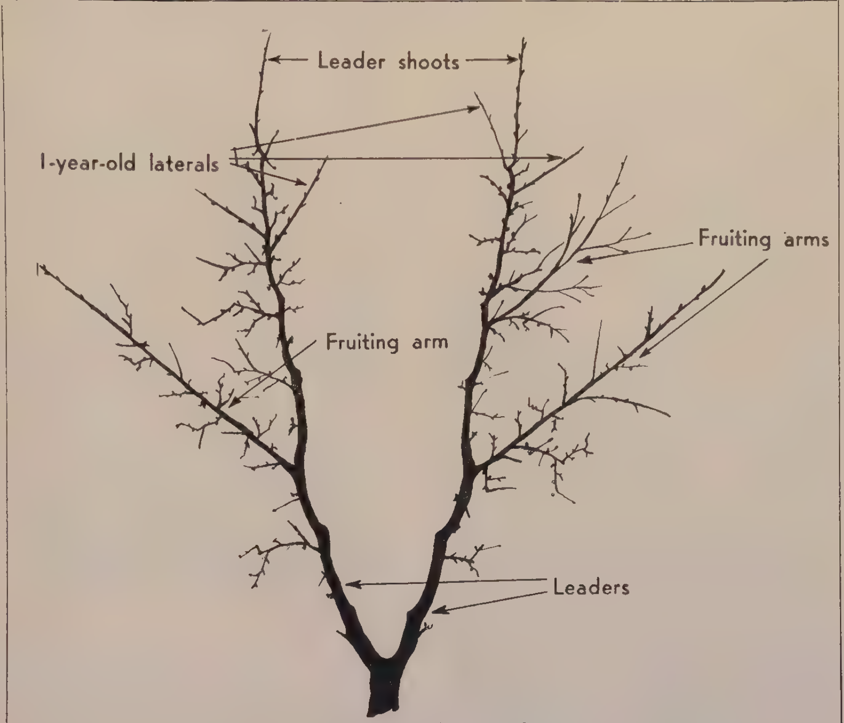
Development of Young Trees

Selection of the permanent framework must be made in the early years of the tree's life. After the tree has been planted two or three strong, upright shoots should be selected and all other growths cut away. To obtain even spacing the shoots left should be cut back by at least three-quarters of their length to buds facing in the direction in which the leaders are desired to grow.

Hard cutting at this stage is necessary to restore the balance between the roots and the top which has been disturbed by the reduction in the roots when the tree was lifted from the nursery.

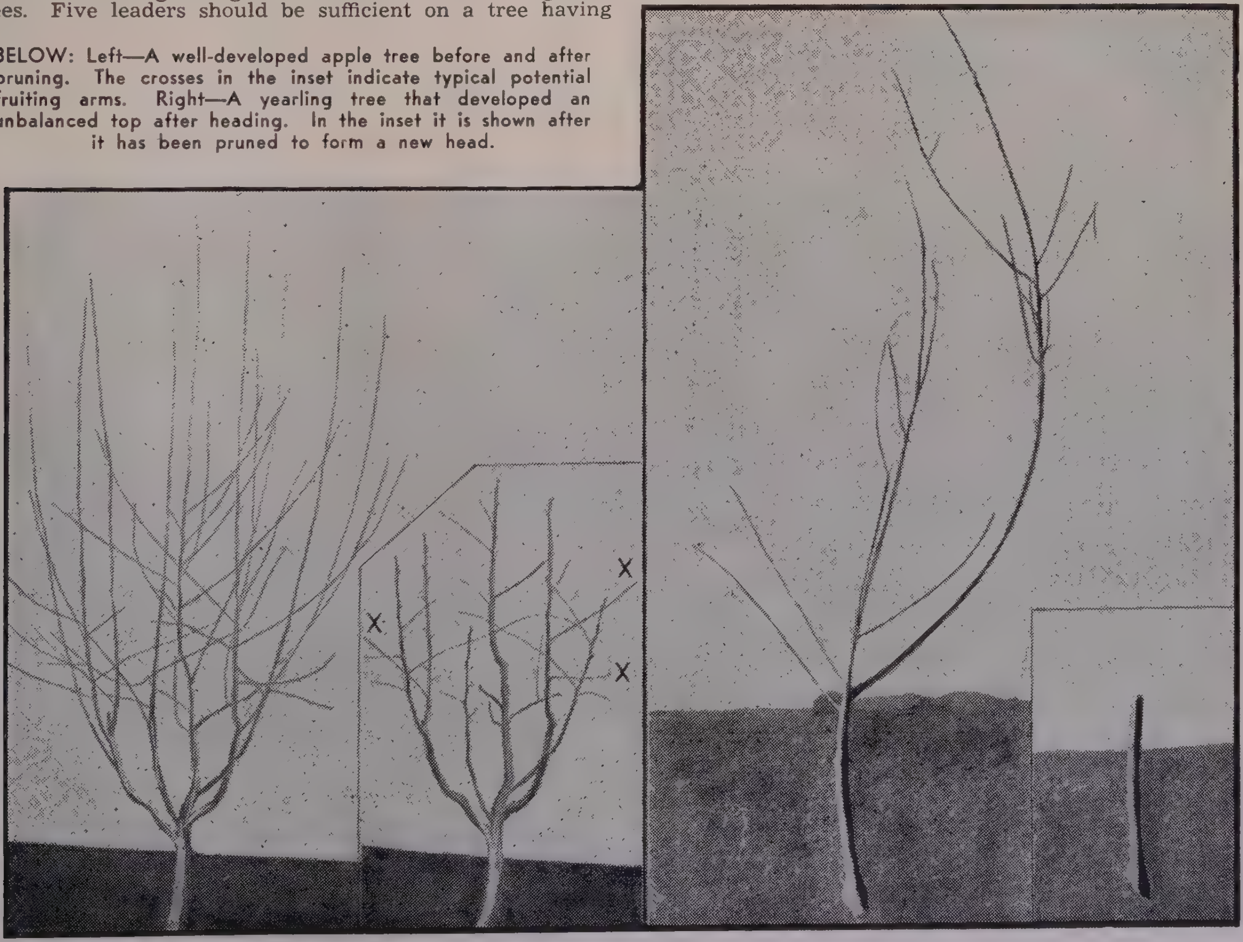
Where all the shoots on a tree are unsuitable for formation of leaders or the tree is unbalanced, having one strong shoot and other weak shoots, the tree should be cut back to leave about 18 to 20in. of the main stem. This will allow new shoots to form, and the framework can be developed from these shoots the following year. Whips should also be headed at this height (see illustration on page 474).

In the second winter's pruning up to five of the strongest and best-placed shoots should be selected for leaders and the remainder should be cut out. Those left should be shortened by two-thirds on weak growing trees and one-third on vigorous trees. Five leaders should be sufficient on a tree having



The tree parts referred to in the text.

BELOW: Left—A well-developed apple tree before and after pruning. The crosses in the inset indicate typical potential fruiting arms. Right—A yearling tree that developed an unbalanced top after heading. In the inset it is shown after it has been pruned to form a new head.



upright characteristics, but on a tree of a spreading nature up to seven leaders may be better, and the additional leaders should be obtained at the third winter's pruning.

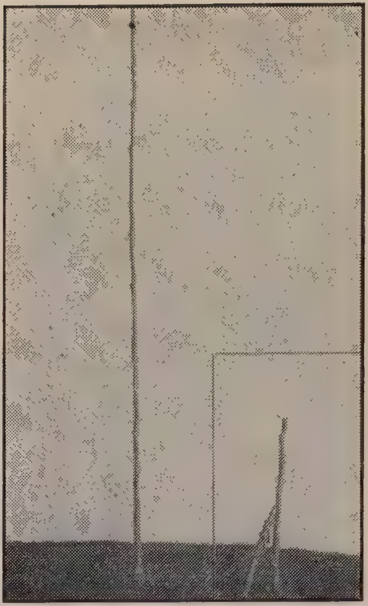
At this stage the development of fruiting arms should be undertaken by selecting a strong lateral on the outside of each leader and cutting it to a bud that will direct its further growth at an angle of 40 to 60 degrees out from the leader. Growths other than the leaders and fruiting arms should be cut out except for a few light laterals on the older wood, which can be left to start the fruiting of the tree.

In the next few years the leaders should be increased in height and other fruiting arms developed at well-spaced intervals. Lateral growth should be encouraged from both leaders and fruiting arms to form the complete fruiting system of the tree.

Treatment of Bearing Trees

The treatment of bearing trees varies appreciably with kinds and varieties.

Apples and pears fruit on laterals and spurs 2 years old or older and annual pruning should consist of removing worn-out fruiting wood and any diseased shoots and shortening healthy fruiting wood to maintain vigour and prevent overcrowding. Leader shoots should be shortened by two-thirds if weak and one-third if vigorous. Annual lateral growths should be thinned out and those left should not be cut. This will encourage fruit-bud formation. The ideal to aim at is to renew all fruiting wood every 5 or 6 years.



A yearling tree not headed in the nursery (a whip). Inset: The same tree pruned to about 18in., the recommended height.

Peaches and nectarines carry their fruit on laterals grown the previous year and consequently new laterals should be encouraged each year. To attain this previously fruited wood should be removed and new laterals thinned out to approximately 6in. intervals to prevent overcrowding. If this is not done, die-back may occur, growth is usually restricted to the ends of existing laterals, and the lower parts of the tree become bare of fruiting wood. Shortening of a number of the laterals to promote growth of new shoots can be done to a limited extent if desired. Leader shoots should be shortened each year.

Plums, apricots, and cherries fruit mainly on spurs 2 years old or older, though some fruit will be borne on 1-year wood. Pruning should consist of removal of spent fruiting wood and dead and diseased shoots and thinning out of new laterals. Where necessary laterals can be shortened to promote greater growth. The laterals of very strong-growing plum varieties should be left unshortened. The aim should be to renew fruiting wood in 3 to 4 years.

When fruit trees are being pruned the following essential points should be kept in mind:—

Air and sunlight are essential to good fruit production. Overcrowding must be avoided and centres of trees must be kept reasonably open.

Hard cutting induces growth and light cutting induces fruitfulness.

A balance between growth and cropping must be maintained.

The results achieved by pruning must be studied each year and the methods used corrected where necessary.

◆

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—*W. R. LOBB, Instructor in Agriculture,*
Department of Agriculture, Oamaru

Book Review

"Deer Hunter": Joff A. Thomson

WHATEVER the ultimate fate of New Zealand's high country may be, there will be a place in its recorded history for the effects on it of the introduction and spread of such pests as deer, chamois, wapiti, goats, and rabbits. There will be assessment, too, of the value of the Internal Affairs Department's culling campaigns. Mr. Thomson's story of his work as a culler for the Department and as a private shooter makes no attempt to discuss the problems of the high country as they concern the research worker, but the incidental comments of a keen observer of wild life, climate, and vegetation in the high country may be of interest to the scientific investigator.

The author's shooting covered a wide area of the South Island and even one familiar with much of the country visited will regret the absence of maps.

A robust story is embellished with 72 illustrations from excellent photographs by the author grouped and well laid out on art paper insertions. The writing is lively and readable, but one feels that with a little assistance the author could have avoided gross grammatical errors without curbing his natural style.

Reeds are doing a splendid service for New Zealand writers and this book shows the imagination that has characterised many of their recent publications. The dust jacket by L. C. Mitchell is excellent. —*G.J.N.*

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◆

Checking the Efficiency of Milking Machines

By W. G. BATT, Supervisor of Farm Dairy Instruction, Department of Agriculture, Hamilton

TO provide an efficient system of servicing milking machines in the dairy industry workers at the Department of Agriculture's Animal Research Station, Ruakura, have been developing methods of testing equipment and building up standards of performance that could be used. Practical trials conducted in the Thames and Te Awamutu districts were outlined in the January and November 1951 issues of the "New Zealand Journal of Agriculture" and the percentages were given of important faults found in the 100 milking machines checked. On those farms where the alterations recommended from the calculations made from the instrument readings were carried out the improvement in milking was most satisfactory and altogether the results of the trial were most encouraging.

BEING large and representative dairying districts the two trial areas were considered to have provided data concerning faults and weaknesses which could be regarded as typical of those likely to occur in the same approximate proportions throughout the Dominion, and the results suggested that the majority of milking machines in use are not kept at a sufficiently high standard of efficiency.

The trial figures indicated that only about 20 per cent. of such machines were kept in efficient milking condition and that the average farmer requires a recommendation based on accurate measurement to form a conclusion to remedy faults. The Dairy Division therefore decided to extend this work as an additional service to farmers by Farm Dairy Instructors.

Ten additional districts were selected for extension and Farm Dairy Instructors were trained and equipped and began the work in their areas during May, June, and July of 1952. As the first two officers concerned with the trials continued the service the addition gave a total of 12 officers and a representation in Northland, Waikato, Taranaki, Manawatu, Wairarapa, Canterbury, and Southland. Farm Dairy Instructorates included Hikurangi, Wellsford, Thames, Te Awamutu, Te Puke, Morrinsville, Stratford, Eltham, Palmerston North, Greytown, Temuka, and Riverton.

The work of checking the efficiency of milking machines within these districts was confined to late autumn and winter and attention was given to those plants owned by farmers requesting the service. In most areas the officers received more requests than they could handle in the limited time and those not checked will have early attention this year.

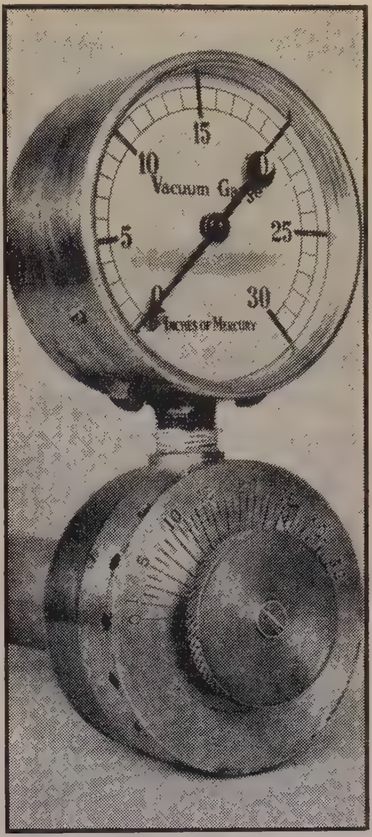
The seal and stamp used by Ruakura Animal Research Station to seal tested meters. The testing and sealing of the meters is a guarantee of their accuracy.

The number of machines checked in the 12 districts during the past winter totalled 546 and a summary of the results and the percentages of important findings is set out. This table will serve as a comparison with the results obtained in the trial.

Total machines checked	546
	Per cent.
Machines efficient, requiring no recommendation	20.6
Air reserve	
Machines with no air reserve ..	5.9
Machines with air reserve under standard	73.5
Vacuum pumps	
Under capacity by inefficiency from wear and tear	11.6
Under capacity for type or size of machine	41.7
Under capacity by insufficient speed	12.1
Vacuum gauges	
Inaccurate by under 1in.	19.6
Inaccurate from 1in. to 3in. ..	34.2
Relief valves	
Obsolete type or unsatisfactory in condition	43.7
Air leaks	
Machines showing air leaks ..	57.7
Pulsators	
At incorrect or irregular ratios ..	37.5
Leaking	12.5
Releaser pulsator incorrectly set ..	26.1
Releasers	
Functioning incorrectly	26.2
Machine parts	
Unsatisfactory piping	9.0
Unsatisfactory rubber	32.0
Faulty parts	.9

As expected, much the same position regarding efficiency was found to operate in all districts and the percentage of faults closely approximated those established in the cross section of the trials. The percentage of efficient machines not requiring immediate attention was 20.6 per cent. compared with 23 per cent. in the trials.

Insufficient reserve of air was found to be a major fault, with 73.5 per cent. of machines below standard and 5.9 per cent. with no reserve air reading. Excessive air consumption, distinct from usual air leaks, contributed to the loss in air reserve in 5.4 per cent. of machines checked, but vacuum pumps under capacity (66 per cent.) was the principal factor. It seems clear that the fault of vacuum pumps under capacity has been due largely to the practice of doubling the sets of teat cups on installed machines without increasing the vacuum pump displacement accordingly. Thirty-four per cent. of vacuum pumps were efficient and of sufficient capacity, 11 per cent. inefficient by wear and tear, 41 per cent. under capacity for the type or size of machine, and 12 per cent. under capacity by reason of insufficient speed.



An air-flow meter developed at Ruakura Animal Research Station. The device is plugged into the machine to measure air consumption, reserve air, and capacity of the pump. The meter readings are compared with a chart giving correct figures for the machine.

Considerable air leaks in 57 per cent. of machines checked further contributed to losses in air reserve, and relief valves in unsatisfactory condition were found in 43 per cent. of the examinations. In many cases an available satisfactory reserve of air was ineffectively controlled by an inefficient relief valve.

The results obtained from the trials and from this extension show the checking of the efficiency of milking machines in use to be desirable and demonstrate clearly that a service based on the readings of instruments is very valuable in this field. It is intended to extend this service to other districts as rapidly as the staff of Farm Dairy Instructors can be trained and equipped.

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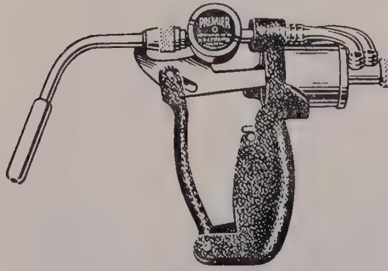

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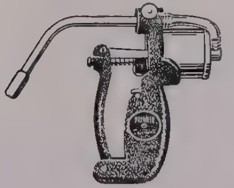

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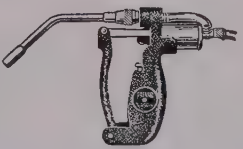

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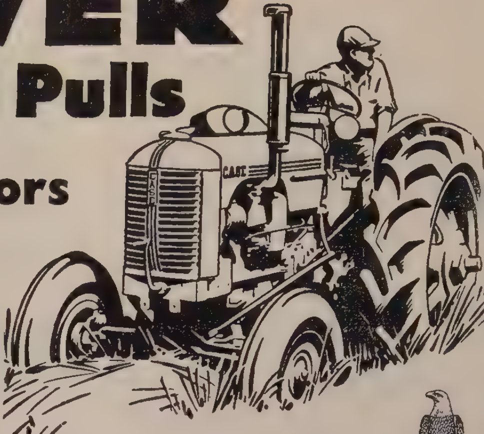

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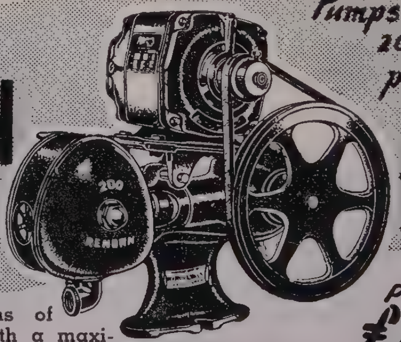

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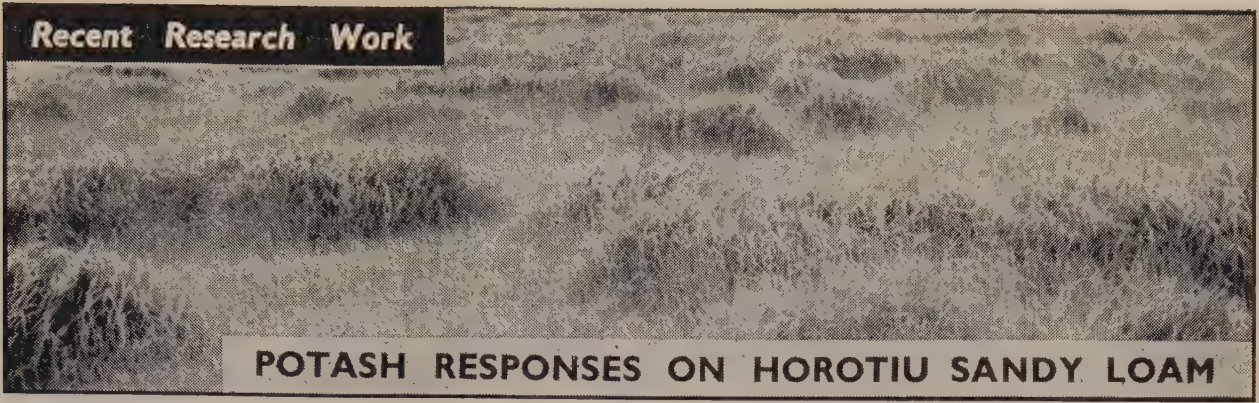


Recent Research Work

POTASH RESPONSES ON HOROTIU SANDY LOAM

A potash-deficient field on Horotiu sandy loam, showing the strong growth on the urine patches in spring.

MANY soil types in the Waikato are showing marked responses from potash topdressing, and recent trials on Horotiu sandy loam indicate that on many fields phosphate and lime dressings without potash have little if any effect in increasing pasture production.

PATCHY GROWTH

PATCHY growth in pastures may be an indication of potash deficiency, and this condition is illustrated above. The patchy growth is most pronounced in early spring and gives the impression that stock manure has not been spread effectively with harrows. However, the field illustrated had been given a good harrowing soon after the stock had been removed. Harrows will spread dung, but the urine patches will remain; and since urine contains a relatively high amount of potash and nitrogen and only traces of phosphate and lime, the patchy response has been caused by potash and nitrogen. The way to overcome this patchiness is to supply potash to encourage clovers, which in turn will later supply nitrogen. Most fields on Horotiu sandy loam on which phosphates and lime have been regularly applied for some years now require an initial dressing of 2cwt. of muriate of potash and thereafter an annual maintenance dressing of about 1½cwt.

TRIALS AT CAMBRIDGE

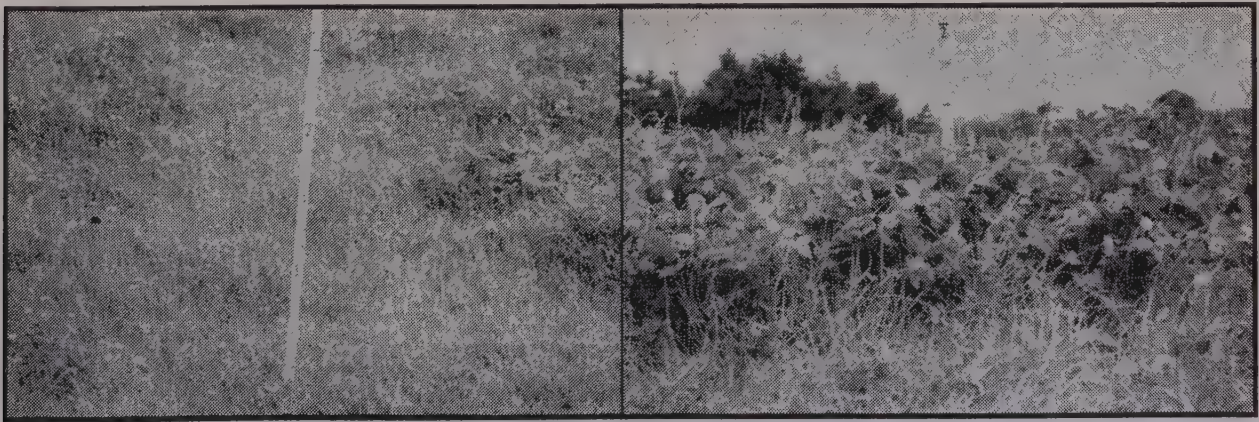
The value of potash on Horotiu sandy loam has been well demonstrated by a trial laid down on the property of Mr. T. H. Ross, Cambridge. Soil tests showed that lime and phosphate levels were high and potash very low. The plots received varying amounts of muriate of potash, from ¼cwt. to 6cwt. per acre, and all plots except one received 6cwt. of superphosphate. The area was grazed and mowed on 7 December and then shut up. Five and a half weeks later the plots were mowed and the produce weighed. The plots which received 6cwt. of superphosphate alone gave no increase over the no-fertiliser area, but the responses from potash increased progressively from ¼cwt. to 4cwt. The 2cwt. plot gave twice the yield of the no-manure plot. The illustration at left below shows the lack of response from the application of superphosphate alone; that on the right shows the prolific growth resulting from the application of 4cwt. of potash. —*A. O. WARNER*

* * * *

POTASH RESPONSES ON OTHER SOILS

POTASH deficiency may be due as much to management and topdressing history as to soil type, and on the same soil type on the same farm one or two fields may be in great need of potash topdressing, though the rest of the farm does not need it. However, it is becoming apparent from trials and other evidence that on soils with a tendency to potash deficiency increasingly larger areas are showing the need for potash topdressing. Potash has become an essential ingredient in pasture topdressing on many farms in the Waihi and north Taranaki and central Taranaki districts. In the lower-rainfall areas of Taranaki marked potash responses are much less frequent. The Taranaki soils are derived from airborne andesitic ash, and similar ash has formed extensive soil areas in the south Waikato and northern King Country districts. In these areas potash responses have become more evident in recent years. The pumice soils of the central plateau area are now showing potash deficiency after being intensively farmed. The tendency to become potash deficient after a relatively short period of intensive farming is, however, not confined to volcanic soils. It has assumed greater importance on those soils because owing to their good drainage and generally satisfactory soil structure they are commonly used for dairying and intensive fat lamb raising.

—*C. DURING*



Left—Where lack of potash is limiting production no extra return is gained by applying superphosphate. The plot on the left of the measuring stick received no fertiliser, and that on the right received 6cwt. of superphosphate. Right—This prolific growth resulted from the application of 4cwt. of potash. The plot in the foreground received 6cwt. of superphosphate only.

Variety with One Mix of Shortcake

By MOLLY MACPHERSON, Field Officer in Rural Sociology, Department of Agriculture, Auckland

VARIETY is the spice of life, and though a day's baking with many different recipes will give the family plenty to choose from, the housewife will find that she has used many bowls and much other equipment, and that changing from one recipe to another has consumed much of her precious time. With the following recipe a large mixing, sufficient so that 10 to 12 dozen smalls, or a small mixing, giving up to 3 dozen smalls can be made. A different variety can be prepared each baking day.

THE shortcake recipe is as follows:—

Large Mixing

5 cups of flour
5 small cups of sugar
5 teaspoons of cake powder
1 teaspoon of salt
17oz. of fat
Milk for mixing
1½ teaspoons of lemon essence (optional)

Small Mixing

2 cups of flour
2 small cups of sugar
7oz. of fat
2 teaspoons of cake powder
Milk for mixing
Pinch of salt
½ teaspoon of lemon essence (optional)

Sift all the dry ingredients into a bowl. Rub the fat thoroughly into the dry ingredients with the tips of the fingers. The mixture will be crumbly. Add the lemon essence (optional). With a knife mix the milk into the mixture a little at a time. The mixture will then be ready to be rolled out on a floured board and made into a variety of squares, tarts, tartlets, rolls, and biscuits, which are baked in a moderately hot oven.

Substitutions

The fat in the mixture may be butter, lard, vegetable fat, or any combination of these. Baking powder may be substituted for the cake powder. The housewife will find that if all the mixed paste is not used on the day of mixing, it will be quite satisfactory for baking on the following day.

Master Mix

If the recipe is followed up to the stage before the mixing in of the essence and the milk, the mixture of dry ingredients with the fat rubbed in may be stored in a tin and any quantity made up at any time with sufficient milk to make a paste. The keeping qualities of this mixture which can be stored depend on the keeping qualities of the fat in the mixture.

Variations

Here are 16 variations of the basic recipe. Other fillings and ideas may suggest themselves to the housewife.

Date Squares

Date filling: 1 cup of dates, ¾ cup of water, ¼ cup of sugar.

Place all the ingredients in a small saucepan and heat the contents, stirring occasionally until the dates become soft. Take sufficient paste to roll two 10in. squares each ¼in. thick. Place one square on a cold oven slide, spread it with the hot date mixture, and cover with the second square of paste. Before baking mark into 2in. squares and prick each square with a fork. Bake in a moderately hot oven (375 degrees F.) until golden brown (approximately 25 minutes).

Apple Squares

Apple filling: 2 cups of hot cooked and sweetened apple slices or thick apple pulp. Take sufficient paste to roll two 10in. squares each ¼in. thick. Place one of the squares on a cold oven slide, spread it with the hot apples, and cover with the second square of paste. Before baking mark into 2in.

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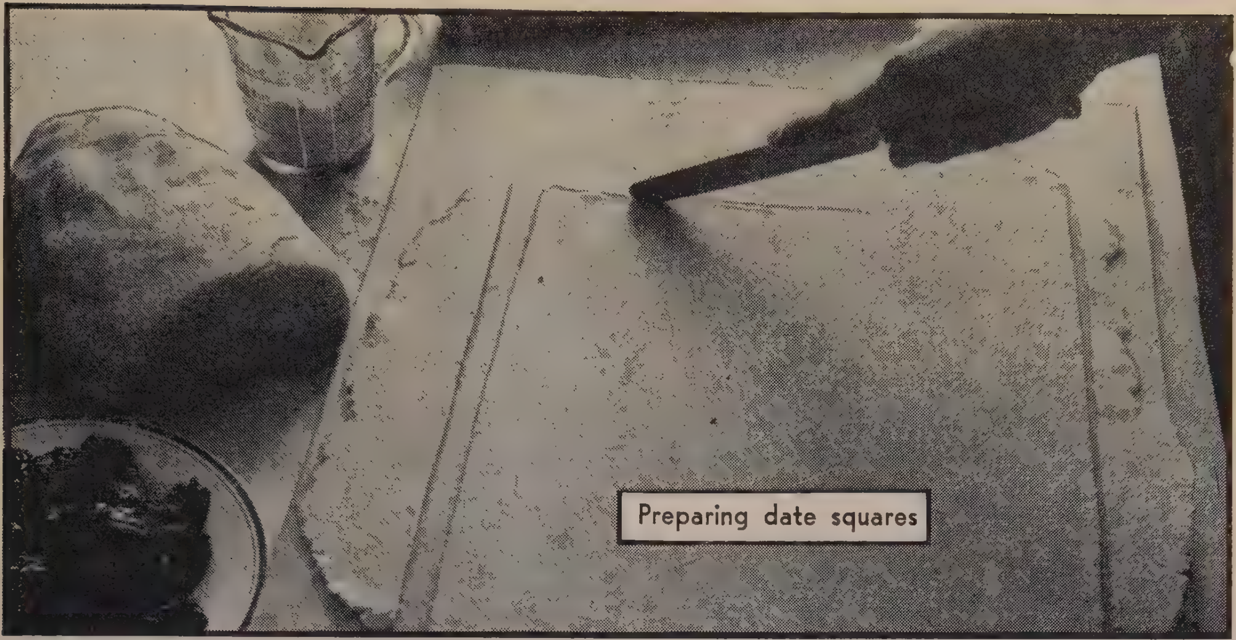


Preparing date squares

squares and prick each square with a fork. Each square may be decorated with a small piece of paste cut into a leaf shape. Bake in a moderately hot oven (375 degrees F.) until golden brown (approximately 25 minutes).

Other fruit squares: Other fruit may be used to make fruit squares, providing the fruit is hot and moist enough to spread, but not wet.

Louise Tart

Coconut filling: 1 egg, 1 small cup of sugar, 1 small cup of coconut.

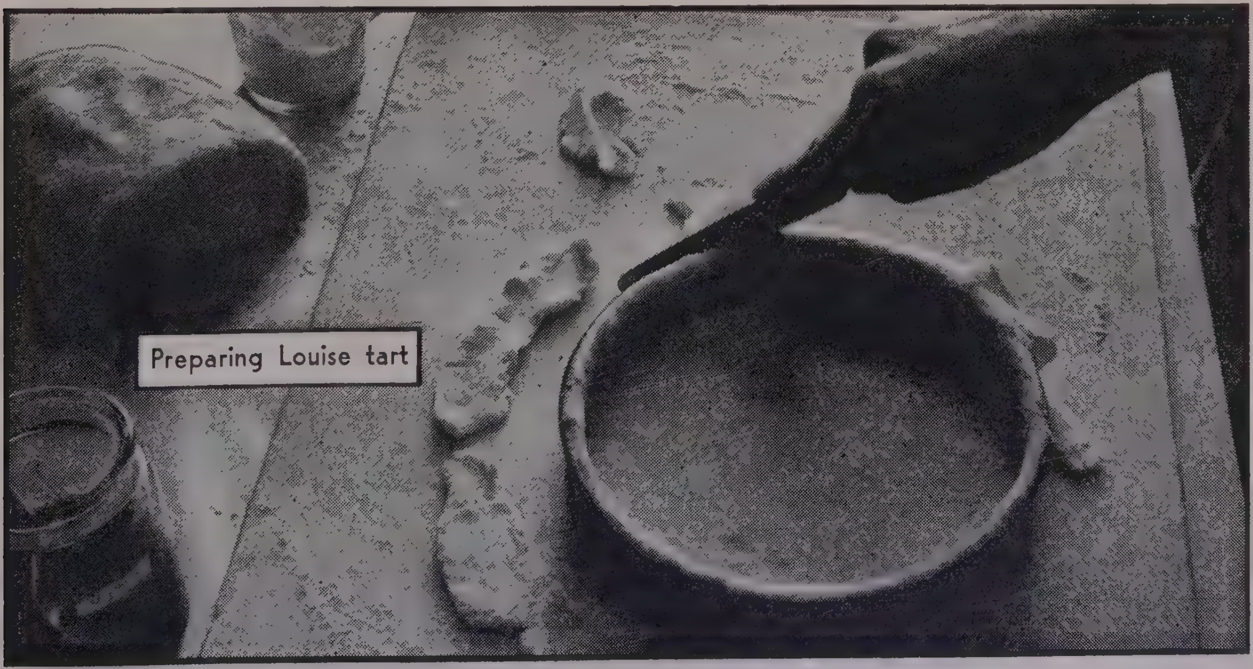
Beat the egg well, and stir in the sugar and the coconut. Take sufficient paste to line two 8in. sponge tins with paste rolled 1/3in. thick. Spread each tart with jam and cover the two tarts with the coconut filling. Bake in a moderately hot oven (375 degrees F.) for 30 minutes or until browned.

Louise Tartlets

Make the coconut filling as for Louise tart. Take sufficient paste to cut 1½ dozen circles ¼in. thick and place the circles in patty pans for tartlets. Into each tartlet put ½ teaspoon of jam and cover with 1 teaspoon of the coconut filling. Bake in a moderate oven (350 degrees F.) for 20 minutes. When the tartlets are cooked loosen them, but leave them to cool in the patty tins.

Jam Tartlets

The small mixing of shortcake will cut into approximately 3 dozen tartlets or sufficient paste to cut the required number can be taken. Roll the paste ¼in. thick and into each tartlet put ¾ teaspoon of jam. Bake in a moderate oven (350 degrees F.) for 20 minutes. When the tartlets are cooked loosen them, but leave them to cool in the patty tins. Before being served the tartlets may be decorated with whipped cream.



Preparing Louise tart

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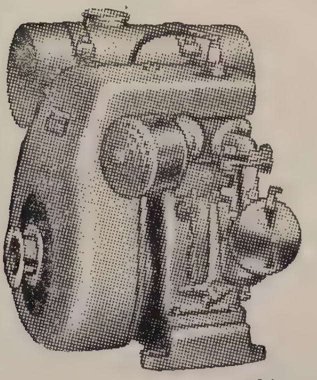

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Preparing tartlets and biscuits

Caramel Tartlets

Caramel filling: ¾ cup of sugar, 1 tablespoon of butter, 2 tablespoons of cornflour, 1 cup of milk.

Place the sugar and the butter together in a small saucepan to heat. Stir the contents until they turn to caramel. Add the milk. Bring the mixture to the boil and stir until all the caramel melts. Thicken the mixture with the cornflour and remove it from the heat; leave to cool a little.

Method: Proceed as for jam tartlets. When the tartlets are cold they can be decorated with the warm caramel filling. Before serving, allow the caramel filling to cool.

Lemon Tartlets

Lemon filling: The juice and grated rind of 2 lemons, 1½ cups of boiling water, 1 cup of sugar, 1oz. of butter, 2 egg yolks, 1½ teaspoons of cornflour.

Boil the water, sugar, lemon rind, and juice together. Mix the cornflour into a smooth paste with cold water and use it to thicken the boiling mixture. Melt the butter and beat the butter and egg yolks into the mixture.

Method: Proceed as for jam tartlets, replacing the jam with the lemon filling or with lemon cheese. When the lemon filling is used the two unused egg whites may be made into a meringue top with 5oz. of sugar and used to decorate the tartlets before baking. Bake in a moderate oven (350 degrees F.).

Maid of Honour Tartlets

Fruit filling: 1 cup of mixed fruit, ½ cup of dates, ½ cup of water.

Put all the ingredients together in a small saucepan and stir. Heat the mixture until the dates become soft.

Meringue top: 2 egg whites, 5oz. of icing sugar.

Beat the whites until stiff, stir in the icing sugar.

Method: Proceed as for jam tartlets, replacing the jam with the fruit filling. Put a teaspoon of the meringue top in the tartlets before baking. Bake in a moderate oven (350 degrees F.).

(All the tartlet recipes may be used for tarts in 8in. or larger tins, as in the method for Louise tart. They will be suitable tarts for dessert.)

Jam Pinwheels

Take the small mixing of short cake, roll out to ¼in. thick or thinner, and spread the rolled paste with jam. Roll up like a jam roll so that the roll is 2in. thick. Cut crosswise into ¼in. slices and bake in a moderate oven (375 degrees F.) until golden brown (20 minutes).

Preparing date rolls

Biscuits with Jam Filling

Take the small mixing of shortcake and roll it out to 1/8in. thick. Cut the paste into various shapes with biscuit cutters. Spread half of the shapes with jam. Take the remaining shapes and place one on top of each of the jam-covered shapes. Bake in a moderate oven (375 degrees F.) until golden brown. When cold the biscuits may be iced in any desired way.

Date Rolls

The small mixing of shortcake will cut into approximately 2 dozen date rolls. Roll the paste ¼in. thick, trim off the edges, and cut into strips 2½in. wide. Place on each strip dates moulded by hand into one long roll 2/3in. thick. Wet one edge of the strip of paste and roll the dates inside the paste toward the wet edge. Cut the long roll into short lengths about 2in. Decorate the top of each roll with knife cuts and bake the date rolls in a moderately hot oven (375 degrees F.) until golden brown.

Raisin and Lemon Rolls

Proceed as for date rolls, replacing the date filling with seeded raisins which have had lemon juice squeezed on to them. Alternatively the raisins may be mixed with a small quantity of lemon peel or marmalade and baked in the same way as the date rolls in a moderate oven (375 degrees F.).

All photographs by Sparrow Industrial Pictures Ltd.

Child's Fair Isle Gloves

AN attractive contrast to a plain coat material can be provided by Fair Isle gloves such as those worn by the young girl in the illustration. The materials required for the gloves shown are 1oz. of 3-ply fingering in natural colour; small balls (about ¼oz.) of 3-ply fingering in green, white, and red, 2 No. 12 and 2 No. 14 knitting needles.

MEASUREMENTS are: Round hand, 6½in. Length of palm, 4in. **Tension** is 9 st. and 10 rows to 1in. over patt.

Abbreviations used are: K., knit; p., purl; st., stitch(es): tog., together; rep., repeat; patt., pattern; cont., continue; beg., beginning; inc., increase dec., decrease; sl., slip; p.s.s.o., pass slip stitch over; N., natural; G., green; R., red; st. st., stocking stitch (1 row k., 1 row p.); W., white.

Right Hand

With No. 14 needles and N. wool cast on 48 st. and work 2in. in k. 2, p. 2 rib.

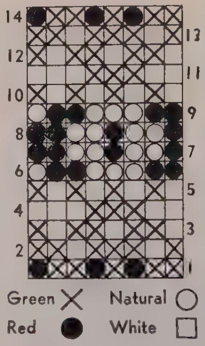
Next row: * Rib 2, inc. in next st., rib 3. Rep. from * to end. (56 st.)

Change to No. 12 needles and work in Fair Isle patt. from chart below, working in st. st., knitting odd-numbered rows, reading chart from right to left, and purling even-numbered rows, reading chart from left to right, repeating chart 7 times across each row. Thus the first 2 rows will be as follows:—

First row: * K. 2 G., 1 R., 1 G., 1 R., 2 G., 1 R. Rep. from * to end.

Second row: * P. 2 G., 1 W., 3 G., 1 W., 1 G. Rep. from * to end.

Complete the 14 rows of patt. from chart, then work the first 8 rows again **.



14	●	✕	✕	●	✕	●	✕	✕	
	✕	✕	☐	✕	✕	✕	☐	✕	13
12	✕	☐	✕	✕	☐	✕	✕	☐	
	☐	☐	☐	✕	✕	✕	☐	☐	11
10	✕	☐	✕	☐	✕	☐	✕	☐	
	○	●	●	○	○	○	●	●	9
8	●	●	○	○	●	○	○	●	
	●	●	○	○	●	○	○	●	7
6	○	●	●	○	○	○	●	●	
	✕	☐	✕	☐	✕	☐	✕	☐	5
4	☐	☐	☐	✕	✕	✕	☐	☐	
	✕	☐	✕	✕	☐	✕	✕	☐	3
2	✕	✕	☐	✕	✕	✕	☐	✕	
	●	✕	✕	●	✕	●	✕	✕	1

Green ✕ Natural ○
Red ● White ☐

Thumb

Next row: Patt. first 37 st. as ninth row, now using N. wool only, cast on 9 st. loosely, turn, p. 18. Cont. in st. st. on these 18 st., using N. for 1¾in. and ending with a p. row.

Shaping the Top

First row: (K. 1, k. 2 tog.) 6 times. Second row: P. to end. Third row: * K. 2 tog. Rep. from * to end. Break off wool and thread through remaining st., draw up, and fasten off. Sew down seam of thumb. Rejoin N. wool to remaining 19 st. of hand and work in patt. as for ninth row to end.

Next row: Patt. as tenth row to beg. of thumb, now sl. the 9 cast-on loops on left-hand needle and cont. in patt. across these st. and to end of row (56 st.). Cont. in patt. until the tenth patt. row of third rep. of chart has been completed. Break off all wools except N.

Next row: K. 2, (k. 2 tog., k. 7) 5 times, k. 2 tog., k. 1, turn, leaving last 6 st. on a safety pin for fourth finger.

Next row: Cast on 1, p. to last 6 st., turn, leaving last 6 st. on a second safety pin. Cast on 1.

First Finger

Next row: K. 27, turn, cast on 1 st., p. 15, turn, cast on 1. Work in st. st. on these 16 st. for 2¼in., ending with a row on wrong side.

Shaping the Top

First row: K. 1, (k. 2 tog., k. 1) 5 times. Second row: P. to end. Third row: K. 1 (k. 2 tog.) 5 times. Break wool, thread end through st., draw up, and fasten off. Sew down seam to base of thumb.

Second Finger

With right side of work facing rejoin wool and pick up 2 st. at base of first finger, k. 6, turn, cast on 1, p. 15, turn, cast on 1. Work in st. st. on these 16 st. for 2½in., and complete as for first finger.

Third Finger

With right side of work facing rejoin wool and pick up 2 st. at base of second finger, k. 7, turn, p. 16. Work in st. st. on these 16 st. for 2¼in. and complete as for first finger.

Fourth Finger

With right side of work facing rejoin wool at base of third finger and pick up 2 st., k. 6 from safety pin, turn, p. 8, p. 6 from other safety pin. Work in st. st. on these 14 st. for 2in., ending with a row on wrong side.

Shaping the Top

First row: K. 2 tog., (k. 1, k. 2 tog.) 4 times. Second row: P. to end. Third row: K. 1 (k. 2 tog.) 4 times. Complete as for first finger, joining seam to wrist edge.

Left Hand

Work as given for right hand until **.

Thumb

Next row: Patt. as for ninth row for 28 st., turn, and, using N. wool only, p. 9, cast on 9 loosely. Complete thumb as given for right hand. Next row: Rejoin wool to remaining 28st. of hand and work in patt. as for ninth row to end. Complete as given for right hand.

Making up

Press work lightly on wrong side. Sew in all ends.

Begonia Varieties and Methods of Propagation

FOR the owner of a small glasshouse no group of plants gives more satisfaction than that of the begonia. With its great variety of species there can be produced an attractive display of flowers or foliage both under glass and out of doors. Propagation of begonias is comparatively simple. The more common species grown are discussed in this article by R. R. White, Horticultural Instructor, Department of Agriculture, Dunedin. Garden work for June is dealt with by C. K. Ellis, formerly Horticulturist, Department of Agriculture, Dunedin.

WHEN first discovered in the Western Hemisphere about 1690 the begonia was found to have no close relationship to any living plant and so a new genus was established. This was dedicated by Charles Plumier, a distinguished French botanist, to Michel Begon, a patron of botany and then Governor of Santo Domingo. Since then many other species have been found in various parts of the world, so that today there are about 1000 members in the genus. Varying widely in form, these have been perfected by hybridisation and selection to give the wide range of excellent types seen today.

Of these the most popular is the tuberous group. They have been derived from such parents as *Begonia pearci*, *B. veitchi*, *B. sedeni*, and *B. boliviensis*. The other types are bulbous, rhizomatous, and fibrous rooted. The bulbous section has only one representative, *B. socotrana*, from the island of Socotra in the Indian Ocean. It was first introduced to Europe in 1880 by Dr. I. B. Balfour, Professor of Botany, Edinburgh, who took it to the Royal Botanical Garden in Edinburgh.

Of the rhizomatous type *B. nelumbifolia* is one of the oldest-known begonias, being described first by Plumier in 1690. It was reported from India in 1700, and Rear-Admiral Bligh found it in Jamaica in 1793. Also in this group is Rex begonia, which originated from Assam.

The fibrous-rooted *B. semperflorens* is the best known of its type. It was used extensively last century by hybridists and gave rise to many new forms, though the original form, with its colourful varieties, is still widely used for flower beds.

[*National Publicity Studios photo.*

Tuberous begonias make a colourful display in any glasshouse during summer. Picking over keeps the show of flowers longer.

Tuberous begonias are grown mainly for their flowers and are the most colourful and therefore the most popular. The large, double-flowering type *B. cameliaflora* can be grown in any greenhouse and is easily propagated from seed or cuttings. Other large-flowered types are the singles *B. crispa*, with frilled edges to the petals, the crested *B. cristata*, and the fimbriated begonia *B. fimbriata*.

In warmer districts in the north of New Zealand tuberous begonias can be grown out of doors.

Growing from Seed

Propagation by seed can be carried out for most types of begonias and the same rules apply for all up to the potting-off or planting-out stage. For seed, the compost used should be that recommended by the John Innes Research Station: A mixture containing 2 parts of loam, 1 part of sand, and 1 part of leafmould or peat to which has been added 1½oz. of superphosphate and ¾oz. of carbonate of lime for each bushel of mixture. The soil mixture should be topped with finely sifted material. As the seedlings are very small, seed can be sown in a pot or shallow pan. The soil surface must be level and should be watered before seed sowing.

As the seed is very fine, mixing it with dry sand helps in its even distribution over the soil surface. Sowing should be carried out from June to August to allow for plenty of growing time in summer. Covering of the seed with soil is not necessary. The pot can be covered with glass and brown paper and is best placed in a warm position in a glasshouse or frame.

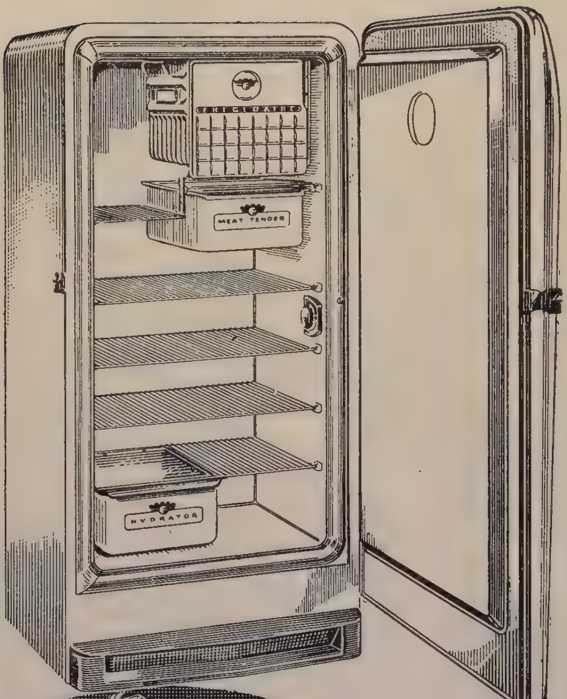
[*Jack Welsh and Sons photo.*

Pot-grown begonia, showing how removal of laterals and buds gives a well-balanced, large-flowered plant.

Pricking out Seedlings

When seeds germinate the seedlings are very tiny and are difficult to handle. A pricking-out stick pared to a flattened point about ⅛in. wide with a small V cut in it can be used. The seedling is lifted from the pan and carried in the V cut in the stick to the pricking-off box. The pricking-off mixture should consist of 7 parts of loam, 3 parts of peat or leafmould, and 2 parts of sand to which has been added 1½oz. of blood, 1½oz. of superphosphate, ¾oz. of sulphate of potash, and ¾oz. of carbonate of lime per bushel of mixture. The topsoil layer should consist of fine topping to take the small seedlings. After pricking off, the box should be watered with a very fine rose watering can, care being taken not to wash out any of the seedlings.

The seedlings now require to be shaded from strong sunlight and kept warm and moist to ensure good growth. The topsoil layer of the box should never be allowed to dry out; daily syringing with water will prevent this. When large enough the seedlings can be either potted off, or if required for planting out in outside beds, hardened off in an outside cold frame or sheltered garden spot.



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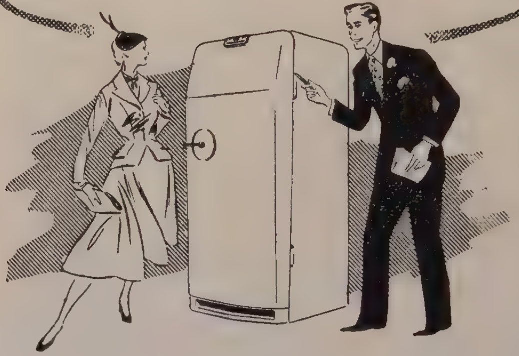

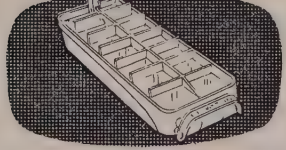

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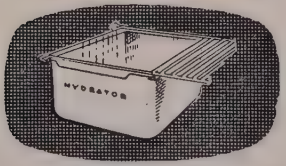

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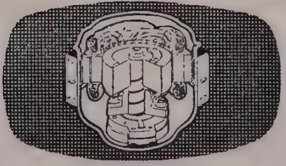

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Growing from Tubers

Tubers of begonias can be started into growth during August and September. The tubers for starting should first be examined thoroughly to see that there are no rotted portions. If decayed patches are found, they should be cut away, together with a reasonable margin of healthy tissue, with a sharp knife and the wound dusted liberally with flowers of sulphur; cut surfaces should be allowed to dry thoroughly in sunshine before tubers are placed in the compost for starting.

An excellent compost for starting begonias into growth can be prepared by mixing equal quantities of well-rotted leafmould and sharp sand. This compost may be spread about 2in. deep in a box and the tubers set firmly in it, leaving a few inches between each.

Each time a tuber is set a check should be made to see that it is the right way up. Normally the top is concave and the bottom convex, so that when the tuber is held with the hollowed-out surface and its mat of dead fibrous roots upward it is in the correct position.

Placement of Tubers

When tubers have been set compost should be scattered about them and the general level raised until the tops of the tubers are not more than a $\frac{1}{4}$in. below the surface. To bury tubers deeply is to invite trouble, because they rot readily.

Next the whole of the soil in the box should be firmed gently and lightly watered.

Boxes should be covered with newspapers or sheets of brown paper and placed in a warm part of the greenhouse. Temperatures of up to 70 degrees F. are quite safe for starting begonias, but the temperature must be reduced as growth becomes evident, or the shoots will grow long and soft.

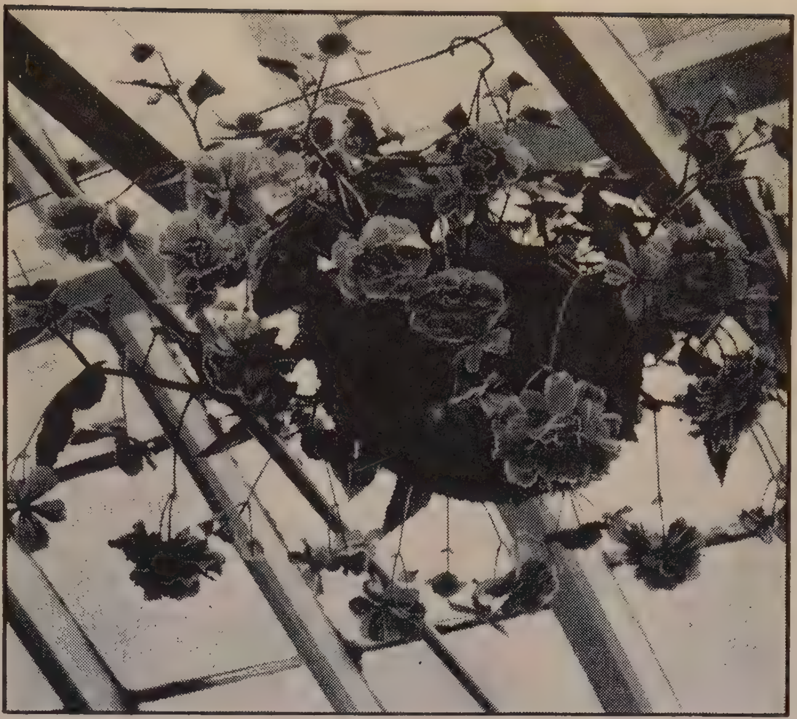
In a few days small, pale pink buds will begin to show. Generally 1- or 2-year-old tubers will move before older ones.

Immediately it becomes evident that the majority of the tubers have started into growth the temperature of the greenhouse must be reduced to about 60 degrees F. and kept fairly steady at this.

On the first dull day the paper covers should be removed so that the leaves may develop freely. Care must be taken to shade the plants from strong, direct sunlight, particularly at this stage.

Potting up

About 2 weeks later the roots should be sufficiently developed to warrant potting up. In the past it has been usual to pot the plant into the smallest pot in which it can be comfortably housed and to grow it on with a series of pottings on to larger receptacles until it reaches almost the flowering stage. Recent experience in growing begonias on a large scale has, however, proved this to be totally unnecessary and that better results can be obtained by potting the rooted tuber directly into the pot in which it will complete its growing and flowering season. This, of course, means a tremendous saving in time and effort and should make begonia growing an even more attractive hobby to many amateur gardeners.



Pendulous begonias make an excellent overhead display in a glasshouse or porch.

The difficulty is to be able to decide what size of pot to put each individual tuber in. Generally it is safe to recommend that 1- or 2-year-old tubers, provided they are healthy and strong, should be potted into 6in. pots, or perhaps particularly vigorous varieties into 7in. pots. Older tubers are potted up into larger pots according to their size and vigour.

As a standard potting mixture the John Innes potting compost is strongly recommended. If this compost is not favoured, another which usually gives good results can be prepared by mixing together 2 parts (by bulk) of good loam, 1 part of leafmould, 1 part of well-rotted animal manure, and 1 part of coarse sand.

In preparing the pots care must be taken to ensure that drainage is adequately provided for, because begonias will not tolerate a wet, soggy soil. Gardeners should not try to economise on crocking material, and should place a generous layer of coarse, fibrous, organic material on top of the crocks before putting any soil in the pots.

Pots should be partly filled with the compost, which should be firmed slightly by jabbing the fingers vertically into it and knocking the pot gently on the bench occasionally.

Next the tuber should be lifted gently from the box in which it has been started and placed in the pot, care being taken that there are no large air spaces beneath tuber or roots.

More potting compost should then be scattered about and over the roots until when the job is finished the level of the soil is about $\frac{3}{4}$ to 1in. below the rim of the pot, with the top of the tuber barely covered, if at all. If tubers are buried deeply, they or bases of stems are likely to rot.

Subsequent Procedure

From this stage onward the secret of success is not found in a complicated series of cultural practices, but in a few simple operations combined with constant care.

How many stems each plant should carry must be decided first, because no begonia can do its best if every bud it produces is allowed to grow and try to carry flowers. Normally, a tuber which is small enough to be grown in a 5in. pot is not big enough to carry two heavy stems. One stem should be the limit for such tubers, and also for some in 6in. pots. Most tubers in 6in. pots can carry two stems, and three should be the limit for plants in 7in. pots. Three stems will be found adequate for tubers in 8in. pots, too, and only with the largest of tubers, grown in 9 or 10in. pots, should four stems be attempted.

As soon as the plants have settled down after potting they will begin to grow vigorously and this is the time to select the shoots which are to be grown on. The unwanted shoots can be eliminated simply by pulling them off with the fingers.

Should the spare shoots be required for propagating as cuttings, they may be left to grow until they are 3 or 4in. long and then be removed by gently pulling them sideways and twisting them slightly.

Temperature, Humidity, and Watering

Once stems are growing freely temperature and ventilation of the house are the main points to watch.

No attempt should be made to grow begonias at high temperatures; 55 to

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65 degrees F. is an adequate range, and where higher temperatures are maintained plants become weak and unhealthy.

Plenty of fresh air must be allowed to circulate about the plants, as the soft, fleshy leaves are particularly susceptible to fungous rots, and high humidities combined with high temperatures often bring about collapse of leaves from which the plants seldom recover.

Watering should be done with the utmost care. Begonias definitely prefer to be rather dry than rather wet, so that overwatering must be avoided.

Removing Side Shoots and Disbudding

Side shoots or laterals invariably arise on the main shoots and normally are not required. They can be removed simply by breaking them off or cutting them with a sharp knife. Where more blooms are required a few laterals may be left to grow. Quality and size of blooms will decrease with the number produced.

Where water is withheld to too great a degree and unnecessarily high or low temperatures are permitted the plants will begin to throw flower buds at an early stage. These early buds are usually pinched out, because the flowers produced from them will be poor. This practice should be continued until it is considered that the plant is large enough to carry its flowers or until the main show of flowers is required. The plants are not harmed by this procedure, provided it is not carried on later than early January, and it will be found most useful for keeping back the show period until the most desirable time.

Staking

As the stems of begonias are fleshy and particularly heavy and the leaves large, staking is imperative. Light bamboo canes are excellent and should be pushed well down into the soil as near as possible to the stems to be staked, but without injuring the tubers. Raffia should be used to tie stems loosely to stakes. The tie must never be tight, because this will restrict growth of the rapidly fattening stem at that point and the stem will snap off at the first disturbance.

Flowering

Begonias are singularly free flowering and seem always to endeavour to display about twice as much bloom as they are capable of holding up. This necessitates thinning. Every second or third bud should be removed, according to the variety and its flowering habits. This should be done when the buds are at a fairly early stage of development; otherwise they take up too much of the food necessary to obtain excellence in the blooms which are left for display.

The buds that are left will grow with amazing rapidity, and as the stems elongate it will be seen that each is compound, consisting of a large, central flower and two smaller, lateral ones. The large, central one is the male and is the showy member of the bunch. The smaller, side ones are females and are never particularly attractive, and should be removed to enhance the appearance of the central bloom.

The flowers are often so heavy that the stems are not able to support them, and wire flower supports, which can usually be obtained at reasonable cost from shops dealing in gardeners' sundries, are needed.

As the blooms pass their best the outer petals begin to decay and this can be taken as an indication that the time has come to remove them. If faded flowers are taken off regularly, good quality will be maintained in subsequent flowers.

Light applications of liquid manure may be necessary as plants approach the flowering stage, but this should never be overdone, as it may produce weak, spindly growths at the tops of stems. Liquid manure should be given only where plants are obviously pot bound. Bunches of roots growing out through the drainage hole are usually an indication of this condition.

Temperatures in the greenhouse should be lowered, if possible, during the flowering season to a maximum of 55 degrees F. and the water supply reduced to the minimum to keep plants in good condition, as these conditions tend to lengthen the life of the blooms.

After-flowering Care

Immediately flowering has ceased the water supply should be decreased in stages. The tuber absorbs much of the material in the stems and leaves to carry it over until next season, and it is unable to do this quickly. Therefore the water supply should not be stopped suddenly, as this will result in sudden collapse of the stems and leaves.

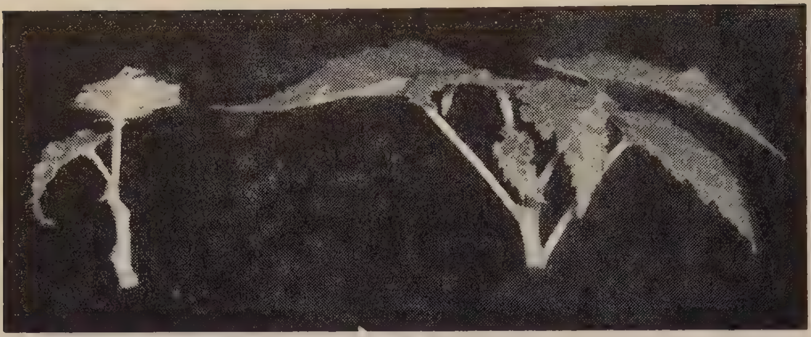
The plants should be looked over regularly while they are dying off and all the withered and decayed portions should be collected up and burnt. This small amount of tidying will help to a great extent to keep down rot in the tubers.

Once the tops have died tubers can be knocked out of the pots and boxed up in some light, dry soil for winter storage. Every month they should be taken out and dipped in a bucket of warm water, dried in the air on a tray, and returned to storage. This keeps the tubers firm and fleshy. It will be found that the larger tubers remain firm much longer than the smaller ones.

Propagating from Cuttings

Shoots from the tubers and laterals from the main stems may be used as cuttings to increase stock. The best cuttings are between 3 and 4in. long. The longer leaves should be removed for convenience and to reduce water loss. The cut at the base of the cutting should be made immediately below a node, that is, immediately below the point of origin of a leaf stem.

Begonia semperflorens bedded out in early summer will make a bright display from Christmas onward.



[*Jack Welsh and Sons photo.*

Begonias are easily propagated from cuttings. The cutting on the left is ready for insertion in the rooting medium.

A cutting should be inserted to about one-third its length in sharp sand, either in a box that can be covered with glass or in a small frame erected on the bench of the greenhouse. The cover over the cuttings should never remain closed, but should be held up ½in. or so at a corner to allow free ventilation.

Cuttings, which should be shaded from strong light, usually root in 3 to 4 weeks. Once the roots are big enough the little plants should be potted up in 3 or 4in. pots. They will grow rapidly under the right conditions and will soon require to be potted on to 5in. or possibly 6in. pots, in which they should be allowed to flower and complete the season. Particular care must be taken with new plants during the drying-off period or the tiny tubers may easily be lost.

Leaf Cuttings

Begonias can be propagated quite freely from leaf cuttings. Though it is not a method that will produce flowers in the first season, it is an excellent one for increasing stock quickly.

Mature leaves with about 2 to 3in. of their stems attached are cut from the plants and the stem is inserted in sand and the blade of the leaf left above it. There will seldom be any apparent activity, but after the leaf has died at the end of the season it will be found that the stem has rooted and a tiny tuber has formed at the base of it. Storage of these tiny tubers is rather difficult, and they should be kept in an accessible place where they can be examined frequently and dipped in warm water whenever they feel soft. These newly propagated tubers should be started in spring in the normal way.

Bedding and Pendulous Varieties

Other varieties of tuberous begonias are the multifloras which, as the name suggests, have large numbers of small flowers. In this group are the small bedding varieties, the pendulous varieties, and the winter-flowering varieties. Among those for bedding the best probably is Flamboyant, a prolific-flowering scarlet double. It is best used in semi-shaded beds which have been well manured. Another good variety, Frau Helene Harmes, can also be used for bedding.

The pendulous varieties are excellent for overhead displays in glasshouses. Wire baskets lined with sphagnum moss and filled with the ordinary potting composts should be used and the varieties treated in the same way as ordinary tuberous begonias both before and after flowering.

Winter-flowering Varieties

The winter-flowering varieties are semi-tuberous and grow only in houses that are heated during winter. They require special treatment, especially during their resting period. During this time they should not be dried off as with the ordinary tuberous varieties. A little water is required to keep the plant growing and the tuber turgid. Care must be taken not to overwater in the non-growing season, as the tuber is likely to rot.

Rhizomatous Begonias

Begonia manicata is the best of the rhizomatous begonias and gives an excellent display of small flowers on long stems and has shiny, dark green leaves. Rhizomatous begonias are best propagated in winter from rhizomes cut into pieces about 1in. long and placed in a warm frame, where they will root from their lower surfaces, forming new plants. They should then be potted and grown on until about December, when they should be transferred to their flowering pots.

Ample warmth and moisture will soon bring them on, and an application of liquid manure once a fortnight will be beneficial. The flowering heads

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Pomaderris elliptica

[*O. Petersen photo.*

THE kumarahou or golden tainui (*Pomaderris elliptica*) is a charming, spring-flowering New Zealand shrub.

During September and October masses of tiny yellow blossoms are produced which give this lovely shrub the appearance of being thickly dusted with golden powder. Plants only 12in. high will sometimes flower.

Many people know the kumarahou as soap bush, because the leaves will lather like soap if rubbed between the hands with water.

Generally from 3 to 5ft. high, the kumarahou grows wild from the North Cape to Tauranga in the east and Kawhia Harbour in the west. Though it will not tolerate severe frosts, it is fairly hardy in coastal districts as far south as Wellington.

It is not very particular about soil conditions; ordinary garden soil with leaf-mould added is ideal. If planted in a windy situation, the plant should be staked.

Propagation is by seed, layers, and cuttings. Seed should be sown in spring on sandy soil in pots or boxes; ⅜in. thickness of ¼in.-diameter gravel is an excellent cover for the seed, allowing watering with an ordinary watering rose without fear of disturbing the seed. Seed pots or boxes should be placed in a moderately shady situation such as the south side of a building. If small, sturdy young plants are selected from sunny situations in their natural habitat and carefully transplanted into the garden in early spring, they will grow into pleasing shrubs.

—*F. E. WILKIN, Horticultural Inspector,*
Department of Agriculture, Auckland

appear from the rhizomes, and dead or rotting leaves must be picked off to prevent the flower heads from rotting.

The flowering period of these begonias can be made to last up to 3 months, if they are carefully handled. After flowering has ceased and as the leaves begin to die off water should be gradually withheld. Enough water should be given through the resting period to keep the rhizomes turgid.

Rex and Trout Begonias

Rex begonias make a colourful display of foliage, and where they can be kept in a moist atmosphere make good house plants. They can be grown in pots or can be massed in the glasshouse if a colourful bed is required. John Innes potting mixtures may be used in both cases. In warmer districts Rex begonias can be grown outside in a shady spot where the humidity can be kept fairly high.

Propagation of Rex begonias is usually by leaf cuttings. The leaf is detached with about 1in. of its stem remaining. About five of the main veins are cut at right angles and the leaf is placed, under-surface down with stem buried, on a bed of peat or leafmould, preferably in a warm frame. The leaf is usually held down with pieces of crock or wooden pegs. A daily overhead syringe with water will keep it growing.

After about 3 weeks roots will appear at the cut portions of the vein and soon new plants will arise. When large enough the new plants can be potted off into appropriate pots for subsequent growth.

The Trout begonias also make excellent house plants and do best in a window away from sunshine. They are so named because of the spots on their leaves, and many beautiful varieties are available.

Fibrous-rooted Types

Of the fibrous-rooted begonias probably the best-known pot plant is Gloire de Lorraine, which produces masses of small pink flowers, which hide most of the foliage. Unfortunately they are fairly difficult to grow and conditions in the glasshouse must be watched carefully. The plants must be kept growing, although care must be taken not to overwater them.

They can be propagated by cuttings taken from new growth or by leaf cuttings. The best rooting medium is sharp sand with a little bottom heat. Disbudding will help to establish the plant until it is ready for flowering. Feeding with a weak solution of liquid manure once a fortnight is beneficial. After flowering the plants require only gentle pruning. Severe cutting back is fatal.

Begonia semperflorens is the fibrous-rooted type used extensively for bedding. It is treated as an annual and raised from seed as described earlier. The coloured foliage and small bright flowers make a very good display during summer. A favourite variety is Indian Maid, which has deep red leaves and bright scarlet flowers.

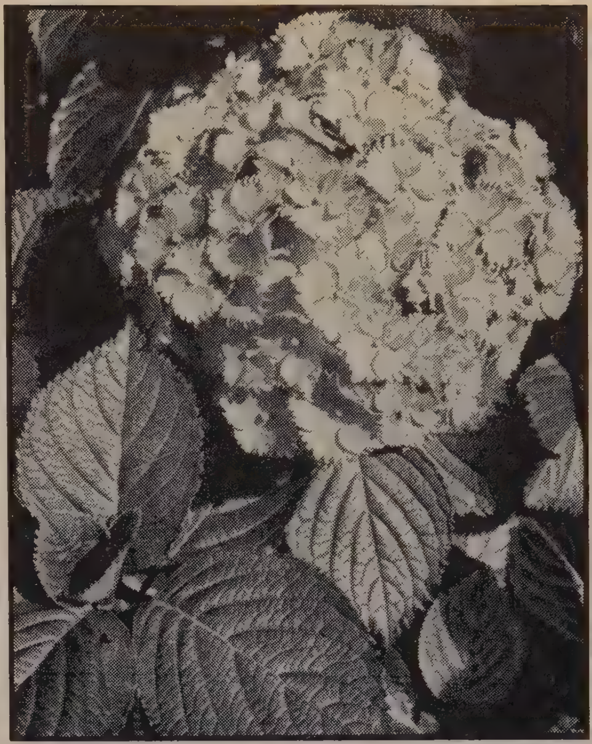
Pests and Diseases

Begonia mite is the most troublesome pest on indoor plants. It can be controlled by spraying with nicotine spray, though a fumigant is better. Dusting with flowers of sulphur is also beneficial.

Stem rot in tuberous begonias is often caused through the plants being overcrowded. If with tuberous begonias one stem only is infected, it is best removed and the plant dusted with sulphur.

Mealy bugs attack the winter-flowering types, including Gloire de Lorraine. Plants can be treated by brushing them with a mixture of methylated spirit and water. A 1 : 800 nicotine sulphate spray with a spreader is also beneficial.

Aphides can become very destructive on begonias and can be controlled with nicotine sulphate spray or a suitable nicotine fumigant. When begonias are being sprayed care is needed to keep the spray off the flowers, as it is liable to burn the petals.



[*Douglas Elliott photo.*

With hydrangeas flower colour depends more on the nature of the soil than on the character of the variety. Naturally white flowers will always remain that colour, but the colour of other varieties, with suitable soil management, may be changed.

Garden Work for June

Bedding plants for spring flowering can be planted up to the end of June in mild districts if the soil is not too wet. Double daisies, primroses, polyanthus, violas, forget-me-nots, wallflowers, gaillardias, and sweet williams are all useful. The last four should all be raised each year from seed sown in summer, and violas are best grown from cuttings taken in late summer. To increase double daisies and polyanthus last year's plants should be dug up, pulled apart, and each piece ("crown") planted separately, with the junction of roots and leaves slightly below the surface.

Chrysanthemums of the late, large-flowered varieties grown in pots for exhibition need a very long growing season. When the flowers finally fade the stems should be cut down nearly to the ground, any long suckers should be cut back to soil level, and the pots stood in a light, airy place to await the growth of new suckers from below the ground. These make the best cuttings, and should be removed for rooting as they appear.

Fuchsias make good pot plants for the house. They are best raised each year from cuttings, but if it is decided to keep this year's pot fuchsias to flower again next year, they should be dried off gradually until the leaves drop and then stood in a cool, frost-free place for their annual rest before being repotted and started into growth again in late winter.

Hydrangea flowers are unusual in that their colours depend more on the nature of the soil than on the character of the variety. Thus a variety that bears bright blue flowers in one garden may have pink ones in a second position, and metallic green flowers in a third place. Varieties with naturally white flowers will not take on any other colour whatever treatment they are given, but the colour of other varieties can be changed more or less at will by suitable soil management. For pink flowers the soil should be dressed with lime each winter at 4oz. to the square yard, or heavier dressings may be given if experience in any particular soil shows that this is not sufficient. Blue flowers can be obtained by dressing the soil in winter with alum or aluminium sulphate scattered for a few feet around each bush at up to 1lb. or more a square yard. Only experience can show how much aluminium sulphate may be needed for satisfactory blueing in any particular soil, but if it is found after winter dressing that the flowers are not a true blue, a further dose of aluminium sulphate dissolved in water can be applied in early summer. Though much cheaper than the aluminium salts, sulphate of iron does not usually produce such satisfactory blues, but is more likely to make the flowers a curious metallic green.

Lawns can be kept healthy only by feeding them regularly. A good fertiliser consists of 3 parts of sulphate of ammonia, 1 part of superphosphate, and 1 part of sulphate of iron applied evenly at 1oz. per square yard, four times a year, one of the dressings being due in June unless the ground is very wet or the district is a very cold inland one, in which case it is probably safer to omit the mid-winter dressing.

New shrubs and trees can be planted if the ground is not too wet. If plants come to hand from the nursery when the soil is not ready for planting, they should be heeled in at once to await conditions more suitable for planting.

"Pricking over" is the term which gardeners use for shallow cultivation with a fork. Deep cultivation is beneficial to the soil, but it is not wise to dig deeply between such plants as shrubs, herbaceous plants, and roses. Such cultivation may cause damage to the roots and so weaken the plants. On the other hand soil which is continually cultivated by hoeing only soon becomes too fine, tends to lose its crumby structure, and cakes badly after rain. At least once a year the ground between shrubs, herbaceous plants, roses, and other permanent plants should be pricked over with a fork, the handle of which should be kept low so that the tines do not go too deeply into the soil, which should be left as lumpy as possible, no attempt being made to break the lumps down. At the same time any fallen leaves on the surface should be buried to rot and return humus to the soil.

Primroses or polyanthus will flower well in the house if lifted in midwinter and potted up into bowls. Each plant should be lifted carefully, the soil washed from the roots, and then it should be planted in the bowl, with moss or good potting compost packed firmly between the roots. Stand the bowl in a sunny position and water the plant only when the compost or moss feels dry, as too much watering will rot the roots. The plants will grow and flower for weeks if potted in compost, but plants set out in moss may show signs of starvation after a week or two and should then either be replaced by new ones or fed with complete fertiliser.

Sow seeds of summer bedding plants in boxes under glass in the mildest northern districts to provide a supply of plants for very early planting; elsewhere it is still much too early to sow seeds, even under glass, as plants produced too early may become starved in their boxes before they can be planted out.

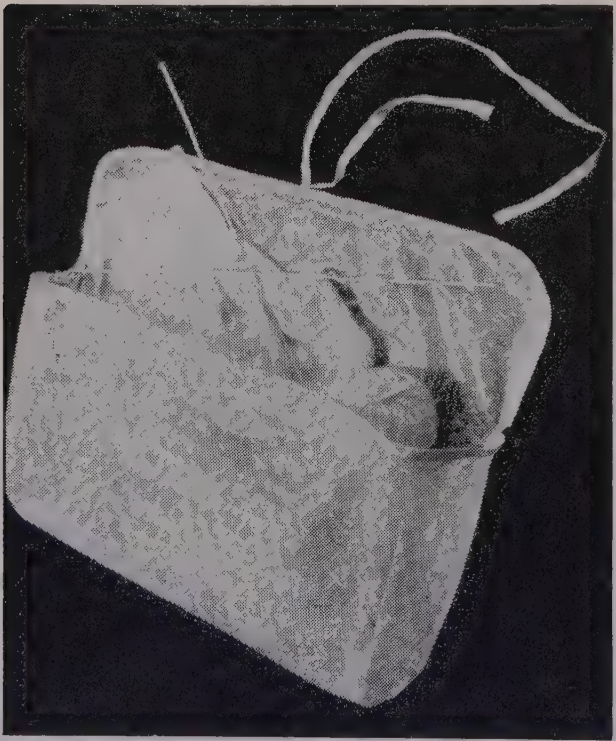
Stones set in path edges, retaining walls, and rockeries should be made firm by ramming the soil thoroughly between, under, and around each stone as it is put in position. After each stone has been laid and before another is added to a wall or rockery, it should be tested to make sure that it is perfectly rigid. However, even well-laid stones occasionally become loosened, especially after a dry season when the soil shrinks away from contact with the faces of the stones. A loose stone is not safe, and walls should be examined carefully each winter. Loose stones should be taken out and relaid, care being taken to make sure that the soil is replaced a little at a time and very firmly rammed as the work proceeds.

Sweet peas succeed best in a specially prepared site. The sooner this work can be put in hand during winter the better, providing the soil is not too wet, as it is an advantage to leave the site for some weeks to settle before the sweet peas are planted. Seed can still be sown in pots or boxes in a cold frame.

Thrips on gladiolus corms: Gladiolus corms should be examined from time to time and the skins removed from a few to see whether they are still in good condition. Brown, sticky staining of the flesh of corms is usually a sign that they are infested with thrips, small active insects with slender, elongated bodies up to 1/10in. long, when fully grown, and ranging from yellow to brown or black. Reports indicate that D.D.T. dust is effective in killing thrips in stored corms. A dust containing 5 per cent. of D.D.T. should be used at 1oz. of powder to each bushel of corms, which are then well shaken up in a bag to mix the powder thoroughly among them.

It is important to control thrips on gladiolus corms and not to plant the corms while they are still infested with the insects, as this usually results in a heavy infestation on the new crops, which may be completely ruined in a dry season favourable to the rapid building up of a big population of thrips.

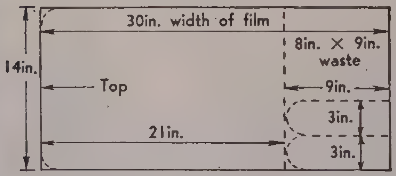
Handy and Attractive Knitting Bag



[*Sparrow Industrial Pictures Ltd. photo.*

THE attractive knitting bag illustrated may be quickly made from plastic film.

The upper of the two drawings below shows how to cut one bag from 30in.-wide film. The length of material required is 14in.

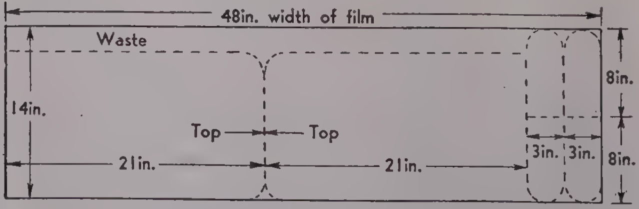


The lower drawing shows how to cut two bags from 48in.-wide film. The length of material required is 16in.

Approximately 5½ft. of bias binding is needed for the tie tapes and to finish the top edges of one bag.

The two side gussets are attached to the main part of the bag by one seam with a fairly long machine stitch, ¼in. seams being allowed for.

The binding is sewn over the top edges of the bag, and the remainder of the tape is attached to the middle of the top flap (see top in diagrams) to form two ties.



This bag is quickly made and is useful for keeping all sorts of things clean and tidy.

—*MOLLY MACPHERSON,*
Field Officer in Rural Sociology,
Department of Agriculture, Auckland

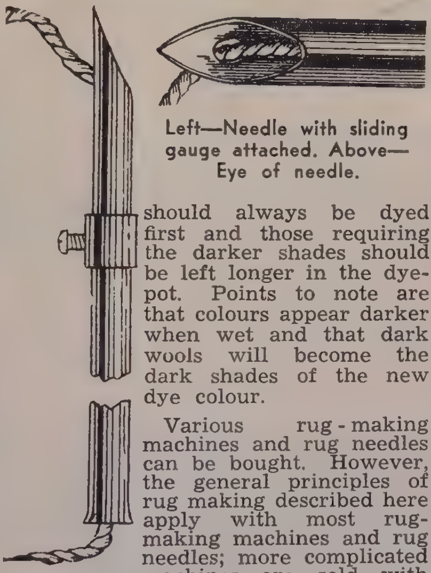
Hooked Rugs

THE making of hooked rugs is not only a means of providing a useful and beautiful furnishing, but is an artistic and pleasant occupation for leisure hours and the odd moments when no other work is offering. Much pleasure will be had from watching the pattern, a picture in wool, take shape, and the finished rug is a real reward for the time and effort required and will stand hard wear for many years. In this article Molly Macpherson, Field Officer in Rural Sociology, Department of Agriculture, Auckland, describes how to make a rug.

HOOKED rugs can carpet a whole room, but of course it is advisable to begin with rugs of small size and place them in special places. The designs can be as original as desired, provided they match or enhance the furnishings.

A look round the rooms of the house will show many places where hooked rugs can be used. Perhaps they will protect the carpet from wear or accent a beautiful floor. They can be used in front of couches or with a group of furniture to make a unit of the group. A hooked rug can look inviting in front of an easy chair or a fireplace or look bright and welcoming in a hallway, and is especially attractive and useful beside a bed, so that there is no cold floor to step on to in the mornings.

For rug making it is possible to buy hessian already stamped with a design or a design can be traced on to burlap, canvas, hessian, or good used sugar bags. Hessian is obtainable in shops in widths of up to 72in. for approximately 5s. per yard. The design must be clear and unbroken on the cloth; if it is not clear, a little Indian ink will easily correct the fault. Shading the design with coloured wax crayons will greatly assist the beginner. For making the pile, rug yarn can be bought, or used but firm unravelled wool is suitable. If the rug is to be made of used wools, home dyeing will give all the colours needed. Materials requiring the lighter shades should always be dyed first and those requiring the darker shades should be left longer in the dye-pot. Points to note are that colours appear darker when wet and that dark wools will become the dark shades of the new dye colour.



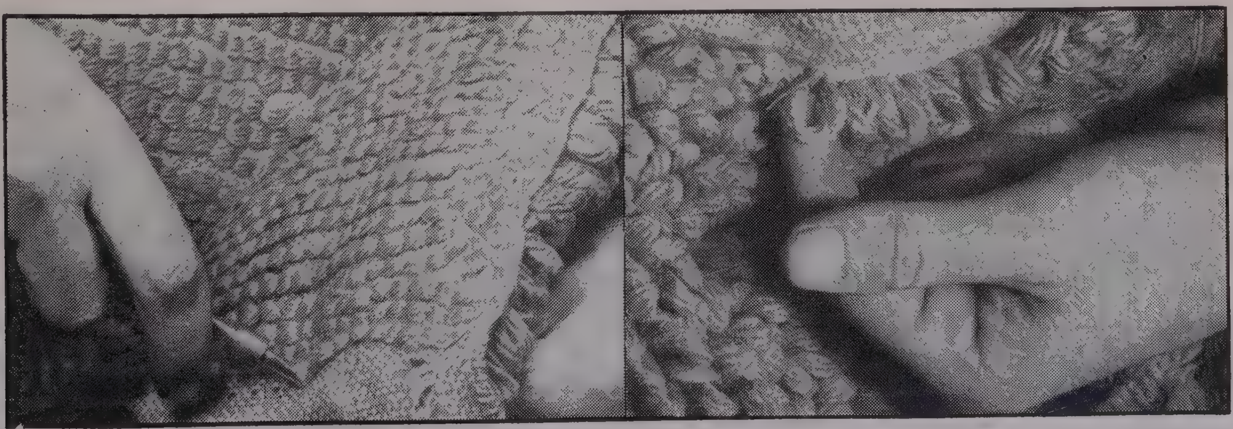
Left—Needle with sliding gauge attached. Above—Eye of needle.

Various rug-making machines and rug needles can be bought. However, the general principles of rug making described here apply with most rug-making machines and rug needles; more complicated machines are sold with full instructions for use.

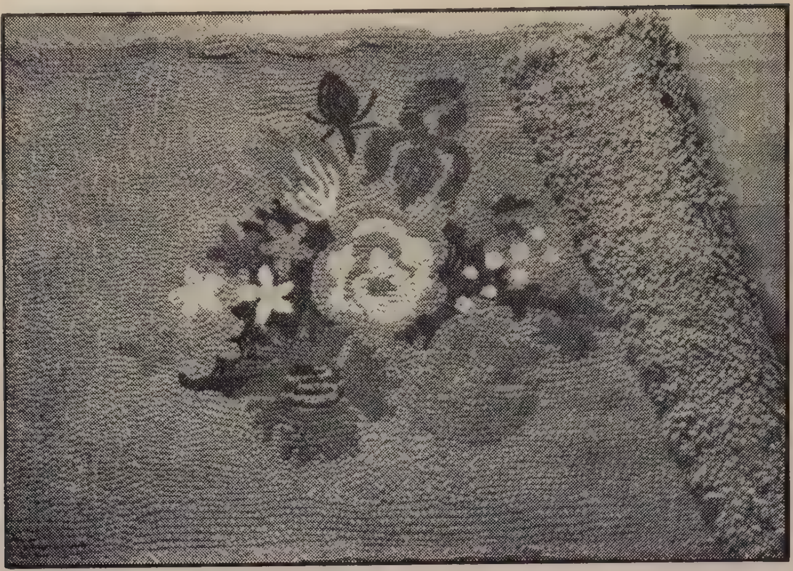
A frame for holding the rug tightly while it is being worked can occupy much-needed space in a busy home and is not necessary, although many people find it easier to work with one. If a frame is dispensed with, it must be kept in mind that the work must be started at the centre of the rug to prevent the rug from "cupping".

The method described here uses one particular needle of simple design which can be bought or can be made by a handyman. This needle is a narrow metal tube approximately 7in. long. It has a slanting cut on one end which forms the point, the pointed side having a hole big enough to thread the rug wool through. A sliding gauge through which the needle runs may be tightened on to it; this determines the length of pile by stopping the "push through" of the needle at the required point so that a pile is not made which is uneven and therefore wasteful of wool. (See illustration at left.)

It is important that the materials used as the base for the rug should be strong and free from flaws. Two or more sugar bags may be joined together by the sewing machine and the outside edges of the material turned back once and tacked to prevent fraying and to give a firm edge. The design is then marked on to the wrong side of the rug base. If the maker is not using a frame, the rug



Left—The wrong side of the rug is uppermost while the rug is being worked and the raw edge is turned in to prevent fraying. Right—The loops which form the pile are on the right side of the rug.



Reverse of the completed rug. The hooking is completed and the rug needs backing. The corner is turned back to show the uncut pile.

can be draped across the lap or across a small table with the side marked with the design uppermost; thus the design is easily followed and the pile will be on the correct side of the rug, which is the side underneath while the rug is being worked. The needle is threaded with rug wool or several strands of finer wool if unravelled wool is being used. (See illustration at bottom left of page 491.)

The base material is held in the left hand and the needle, which is held in the right hand, is pushed between the threads of the material until the needle gauge prevents it from going in any farther. To prevent the work unravelling, on this first insertion the wool must be pulled through so that its cut end is on what will be the right side of the rug when the work is completed. The needle is then withdrawn and, skipping one or two threads of the base material, is pushed in again to the depth the gauge allows and then withdrawn. A loop of wool will be left on the underside of the work. Continue working in this manner, filling in first the centre of the rug and working toward the outer edges, making rows of loops with two or three threads of material between each row. The loops are kept close together so that the rug is firm and evenly covered.

If the work shows a tendency to "cup" and not lie flat, more space should be left between each loop. When a colour is changed or a length of wool used up the wool end is drawn through to the pile side and snipped to the pile length. It is most important to draw all the wool ends through to the pile side of the rug. If this is not done, the wool may easily pull out.

The pile may be left uncut or cut in the finished rug. If the pile is cut, it is easier to cut sections of it as the work progresses; it can be trimmed evenly when the rug is completed. The rug will give better wear if it is lined with a fairly thick material such as that used for the base, or with hessian with a plastic material on it, which can be obtained for a few shillings a yard. This hessian material is ironed on to the back of the rug and is quite firm. A piece of rubber tacked on the wrong side to each end of the corners of the rug will prevent the rug from slipping on a polished floor.

All photographs by Sparrow Industrial Pictures Ltd.

Easy Method of Chopping Nuts

FINELY chopped nuts, sprinkled over the icing of cakes, added to fillings for lunchbox sandwiches, or used as a topping for biscuits, ice cream, or pudding, will add flavour and interest to many different foods. For speed in chopping use a round biscuit cutter. This method takes less time and saves the edges of finely sharpened kitchen knives.

—NORMA K. METSON, formerly Field Officer in Rural Sociology, Department of Agriculture, Wellington

Apple Cobbler

A VARIATION of that old favourite the apple pie, apple cobbler, the recipe for which is given below, is a good hot pudding for a cold day. It will make 6 to 8 servings.

4 to 5 cups of peeled, sliced apples
6oz. of sugar
1oz. of flour
1 teaspoon of cinnamon
½ teaspoon of allspice
½ teaspoon of nutmeg
2 tablespoons of grated, fresh lemon rind
2 fl. oz (or ¼ cup) of lemon juice
2oz. of melted butter
8oz. of sifted flour
3 teaspoons of baking powder
1 teaspoon of salt
2oz. of sugar
4oz. of butter
5 to 6 fl. oz. of milk (approximately)

Arrange the apple slices in a greased oven dish of heatproof glass (about 10in. x 6in.). Mix together 6oz. of sugar, 1oz. of flour, spices, and lemon rind and sprinkle them over the fruit; pour the lemon juice and melted butter over the mixture. Cover it with the lid of the oven dish and bake it at 425 degrees F. for about 40 minutes or until the apples are almost tender. Sift flour, baking powder, salt, and sugar into a mixing bowl. Add the butter and cut it into the mixture until it resembles coarse breadcrumbs. Add milk to make a dough that is soft but not sticky. Turn it out on a lightly floured board and knead it lightly for ½ minute. Roll the dough to ¼in. thickness and adjust it over the cooked apple filling. Press edges down and cut gashes to let steam escape.

Bake the pudding at 425 degrees F. for about 25 minutes and serve it hot.

—BETTY JOHNSTON,
Field Officer in Rural Sociology,
Department of Agriculture,
Wellington

Salads Can Bring Variety to Winter Meals

MENTION of salads brings to mind a cool, refreshing, and light meal to be enjoyed chiefly on hot summer days, but there is no reason why raw greens and other cold foods should not be enjoyed in winter too. Winter salads may be more substantial than those in summer and probably will be without lettuce, but they can still form an interesting accompaniment to cold meat or be served as a course on their own and they bring welcome variety to winter meals. This article by Eirene E. Unwin, Field Officer in Rural Sociology, Department of Agriculture, Christchurch, describes salad making in general and gives recipes for some typical winter salads. Many more combinations and new ingredients can be contrived by the resourceful housewife, but the suggestions given should prove that salads need not be confined to summer days alone.

LETTUCE may be used if available, but cabbage heart or the green part of tender silver beet leaves can well be substituted and are available all winter. These new greens should be shredded finely and mixed with lettuce at first if the family is likely to object to them. Later when they are used as the only green they will then probably be accepted. If the salad is carefully prepared, no one may be any the wiser. Because they are not as tender as lettuce, they should always be shredded finely and this influences the arrangement of the other ingredients. Ways of producing an attractive salad other than with the use of lettuce "cups" must be devised. Other greens which may be tried as a garnish are water cress (which should be very thoroughly washed to avoid danger of hydatids infection), nasturtium leaves, tender leaves from the common dandelion (the one with "clocks" beloved of small children), and endive. Endive is little known in New Zealand, but is easily grown here. When nearly mature the plants should be covered with a box for a day or two before picking to make the leaves more tender. This may also be done with the dandelion.

Winter salads can be varied greatly. They should be fairly substantial, and may include cooked potatoes, left-over or tinned meat or fish, nuts, cheese, bananas, tree tomatoes, dates, raisins, prunes, grated raw or sliced cooked winter vegetables, tinned or bottled fruits such as pears and peaches (or for special occasions pineapple), tinned vegetables, especially peas, and bottled tomatoes. Winter salads are very useful for using up left-overs, but care must be taken to see that already-cooked foods are sufficiently well seasoned and have not become messy.

Essentials in Salad Making

The greens should be crisp, nearly dry, cold, and fresh. The last requirement is easy for those with their own gardens. Wash the greens thoroughly in cold water just before serving, but do not soak them. Shake or swing them dry in a tea towel or wire basket. If necessary, leave them hanging in the tea towel in a draught to crispen. This is better than long soaking if the leaves are wilted.

In choosing the salad mixture consider the flavours, colours, and textures that are to be combined and be sure that all ingredients blend well and are sufficiently flavoursome. To attain a balance consider also what is being served for the rest of the meal.

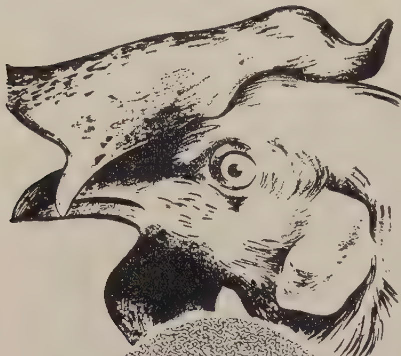
Do not use too many different foods in one salad. Meats and raw vegetables should be cut into pieces small enough to be eaten easily without further cutting on the plate. Softer foods such as pear or cooked beetroot may be in larger pieces, as these can be cut quite easily with a fork before being eaten.

Great variety may be obtained in the way the ingredients are arranged, but messy results should be avoided. There is much scope for the artistic housewife to exercise her talents in the making of attractive salads.

Ways of Serving Salads

Winter as well as summer salads may be served either in a bowl, when they usually accompany meat, or individually as a complete course in themselves. Salads in a bowl often have a greater proportion of greens, the other ingredients being used mainly as a garnish, though they may

HEADING PHOTOGRAPH: Stuffed prune salad garnished with slices of tree tomato. It makes an appetising and colourful dish for a fireside meal.



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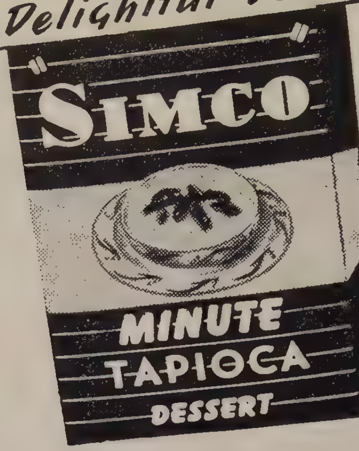

Try this Recipe for
TAPIOCA CREAM

Stir 2 tablespoons of MINUTE TAPIOCA into 1 pint hot milk. Cook gently for 5 minutes, stirring constantly, then remove from heat and add a beaten egg yolk. Continue cooking for further 5 minutes, then fold in lightly beaten white of egg.

MINUTE TAPIOCA

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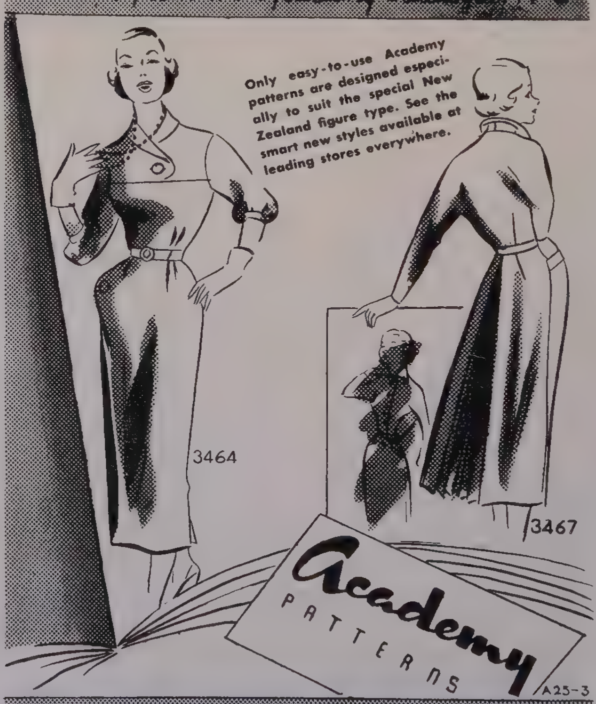

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be arranged right through the salad in layers with the greens. With individual salads it is often the green which is in effect the garnish, particularly with winter salads, when a mixture of some of the heavier foods already listed forms the bulk of the serving.

When individual salads are made the quickest method is to put out all the plates first, then arrange the first ingredient on each, then the second, and so on. A bed or ring of shredded greens should be put down first and the other ingredients arranged on it. Usually a little dressing is poured over the salads just before they are served and a coloured garnish often adds zest.

Garnishes

Most housewives are familiar with parsley, chives, tomato, and small pieces of beetroot used as garnishes; other useful garnishes are sieved, hard-boiled egg yolk, grated carrot, cubes of apple with a bright red skin, tree tomato, grated cheese, mint, paprika (a bright red, mild-flavoured pepper), sliced radishes, banana rings, sliced or cubed raw fruit (lemon juice should be squeezed over these last two to keep them from going brown), raisins, nuts, canned peas, onion rings, and chunks of tomato jelly. The choice of garnishes should be those that will blend with the other ingredients and improve the flavour, not detract from it.

Winter Salad Recipes

Instructions in most winter salad recipes are for individual salads, but the ingredients can usually be served equally well in a bowl. However, the arrangement would then vary and might not be so attractive.

Stuffed Prune Salad

Shredded greens
4 to 5 large prunes
1 to 2 tablespoons of grated cheese or cottage cheese
1 to 2 tablespoons of chopped nuts
½ to 1 tablespoon of dressing

Soak the prunes overnight unless dessert prunes are used. Dry them and remove the stones carefully, leaving a long slit down the side of each. Mix the cheese, nuts, and dressing to a paste and stuff the prunes with this mixture. Arrange them on a bed of shredded greens, sprinkle more chopped nuts over the top, and serve the salad with dressing. The cheese mixture may be coloured orange or red with a little tomato pulp or finely chopped beetroot. (The amounts given are required for each serving.)

Mixed Salad

2 tablespoons of grated carrots
2 tablespoons of grated turnips
Salad greens
2 tablespoons of sliced celery
2 tablespoons of grated raw beetroot

Arrange the grated vegetables on finely shredded greens or on lettuce leaves. Serve with dressing. The bright colours make this very attractive. To make it more substantial add sieved, hard-boiled egg. (Serves 1 or 2.)

Apple and Date Salad

1 tart apple cubed
¼ cup of cut-up dates
½ tablespoon of sugar
⅛ teaspoon of salt
1 tablespoon of lemon juice
2 tablespoons of dressing

Mix the apples, dates, lemon juice, salt, and sugar. Moisten them with dressing and mix them thoroughly. Serve on shredded greens and garnish with chopped nuts.

A variety of winter salads. The ingredients used—prunes, cheese, celery, beetroot, banana, carrot, tree tomato, canned pineapple, and shredded winter greens—are all available in winter. This picture shows only a few of the attractive arrangements and tasty combinations possible. Note the use of celery leaves as a garnish in the two banana salads.

Green and Gold Salad

6 carrots
⅔ cup of seedless raisins
⅓ cup of dressing
¼ teaspoon of salt
2 tablespoons of top milk
¼lb. of tender, fresh silver beet leaves

Grate the carrots and add the raisins. Combine the dressing, top milk, and salt. Sprinkle this over the carrots in a bowl and toss the mixture lightly. Shred the greens finely and serve them with the carrot mixture. This salad can be arranged with the greens at either end of a long dish and with the carrot heaped in the middle or with the greens in a ring around the carrot mixture; the dish can be arranged as individual servings or in a bowl or on a platter. The white stalks of the silver beet should be kept and served at another meal as a hot vegetable.

Potato and Tomato Salad

Cooked potato cubed and mixed with dressing while still hot
Bottled or canned tomatoes or tomato pulp
Chopped hard-boiled egg
A little lightly cooked bacon chopped finely
Vinegar
Gelatine
Paprika
Parsley
Sugar
Shredded greens

Mould the tomatoes with a little gelatine, adding sugar, vinegar, and chopped parsley to improve the flavour. If the salad is to be used the day the jelly is made, use 1 level measuring tablespoon of gelatine to each cup of tomato and dissolve it thoroughly in a little hot juice before mixing it with the bulk of the tomato. If it is to be used the next day, 1 dessertspoon of gelatine is sufficient. Set it in old cups or very small bowls for individual servings.

Arrange a bed of greens, unmould the tomato on to the middle of this, and arrange the mixed potato, egg, and bacon round the jelly. Sprinkle a little paprika over the potato and decorate the tomato with a sprig of parsley.

Other ways of serving this salad with or without the use of gelatine can be devised by the enterprising housewife.

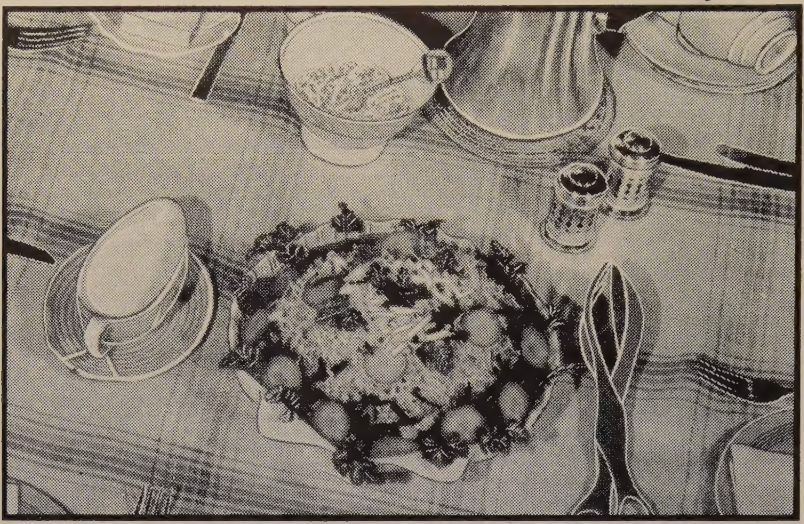
Tinned Fish Salad

Arrange tinned fish (whole, mashed, or in chunks) on shredded greens with celery sticks. Decorate with something coloured, such as hard-boiled egg, grated or cooked beetroot, green peas, and parsley, which will also add flavour. If the fish has been packed in oil (for example, sardines or herrings), squeeze a little lemon juice over it. Serve with dressing.

Cold Meat Salad

Well-seasoned, cold minced meat
Tomato pulp or sauce
Herbs
Hard-boiled egg
Onion chopped finely and fried
Chives
Parsley or meat or vegetable extract

Mix the meat and tomato and add a selection of the other ingredients to improve the flavour. Other cooked vegetables such as peas, carrots, swedes, and string beans may be added. Pile the salad into lettuce cups or inside a ring of shredded cabbage heart mixed with dressing. Add a colourful garnish—beetroot, sieved,



Carrot and cheese salad with parsley. On a bed of shredded cabbage heart this salad is colourful, nourishing, and quick to prepare.

hard-boiled egg yolk, grated carrot, etc.—and serve with dressing.

If the meat mixture seems tasteless, add chutney, Worcestershire sauce, or plum sauce. It is most important when serving cold meat salads to flavour the mixture very well or the result will be uninteresting.

Banana and Raisin Salad

Banana cut into slices about 2in. long
Seedless raisins
Chopped nuts
Apple (if liked)
Lemon juice

Arrange bananas and raisins on a bed of shredded greens. Add cubed raw apple if it is to be included. Squeeze lemon juice over the banana and apple to prevent its going brown. Sprinkle chopped nuts over the top and serve with lemon dressing. Alternatively slices of peeled tree tomato may be used instead of the raisins or both may be used together.

Cabbage Salad

Choose a firm white heart of cabbage and cut it into several pieces; wash them thoroughly, but do not soak them. Shred the cabbage very finely and mix it thoroughly with dressing. Serve it piled in a bowl garnished with coarsely grated raw carrot, rings of hard-boiled egg, beetroot (grated raw, or cooked and cut in rings or cubes), sliced banana, raisins, or whatever is available and can be made to look attractive. Serve as a tea or lunch dish or as an accompaniment to meat.

Winter Vegetable Salad

Green parts of tender silver beet leaves
Cooked string beans (salted or bottled)
Carrots grated or cooked and chopped
Beetroot cooked and sliced or chopped

Mix the beans and carrots with dressing and arrange them in alternate layers with finely shredded silver beet in a bowl. Decorate with beetroot and grated raw carrot. Serve as an accompaniment to cold meat or fish.

White Salad

2 cups of cold cooked potato cubed
1 small head of celery
A little grated onion
Finely chopped parsley
1 or 2 chopped hard-boiled eggs
½ cup of dressing
Seasoning
Brightly coloured garnish

Wash the celery and cut it small. Keep out some of the leaves for decorating. Mix all the ingredients except the garnish together. Serve in a bowl decorated with the celery leaves and the brightest garnishes available (beetroot, paprika, egg yolk, parsley, broken-up tomato jelly, water cress, etc.). Serve with cold meat.

Jellied Salads

Jelly Base

1 tablespoon of gelatine soaked in 4 tablespoons of cold water and then dissolved in ¾ cup of boiling water
6 tablespoons of lemon juice or vinegar mixed with ⅔ cup of cold water
½ to ¾ cup of sugar (for jellies containing fruit only)

When the gelatine is thoroughly dissolved add the sugar if required and the lemon juice or vinegar mixed with the cold water. Use to set savoury meat, fish, tomato, or vegetable mixtures for jellied salads for special occasions. A little sugar may be used with vegetable salads and with tomato, but not with meat or fish.

The following are suggestions for savoury jellied salads:—

Make 2 cups of jelly base (without sugar) and pour a little into the bottom of a mould. When this has nearly set arrange a layer of cooked, minced, well-seasoned, and well-flavoured meat or fish with or without vegetables on top of it. Pour a little more jelly liquor over this to hold it in place, allow it nearly to set, and arrange another layer. The first layer and the outside are all that will show when the jelly is unmoulded, so these should be arranged to look attractive and perhaps a slice of hard-boiled egg or other garnish could be set into them.

Make up a savoury mixture of minced, cooked meat or fish and vegetables, mix it with the jelly liquor, and pour it into a wet mould to set. When unmoulded decorate with grated raw vegetable, parsley, water cress, sieved egg yolk, etc.

Use a mixture of cooked or raw vegetables. Choose ones that will blend well and are sufficiently flavoursome. Season them well. Set in layers as in the first suggestion above or mix them with the jelly liquor as in the second. Be sure the outside will look attractive when it is unmoulded.

Serve any of these jellies on a bed of shredded greens for individual salads, or if the jelly is made in a single large mould, serve it within a ring of shredded greens on a platter. Serve with dressing. Cabbage greens may be tossed lightly with dressing before being arranged.

Recipes for Salad Dressings

Cooked Salad Dressing (No. 1)

1½ tablespoons of butter (or gravyless fat)
1½ tablespoons of flour
1½ tablespoons of sugar
1 teaspoon of mustard
Pepper
¾ teaspoon of salt
¼ cup of vinegar (or lemon juice)
1 egg
¾ cup of milk

Mix all the dry ingredients, add the beaten egg and the milk gradually, and last the vinegar drop by drop, stirring all the time. Cook this over hot, not boiling, water until it is thick, still stirring continuously. It will curdle very easily, so do not overcook it. If it does curdle, beat it with an egg beater, which may restore its smoothness.

Condensed Milk Salad Dressing (No. 1)

1 egg yolk
1 teaspoon of sugar
¼ teaspoon of mustard
1 dessertspoon of vinegar
⅛ teaspoon of salt
2 tablespoons of sweetened condensed milk

Mix the dry ingredients and add the egg yolk. Gradually stir in the condensed milk and then the vinegar slowly.

Cooked Salad Dressing (No. 2)

1 cup of cream (sour or sweet) or a mixture of cream and milk. Milk may be sour, but not solid
1 to 2 tablespoons of sugar
½ teaspoon of salt
1 teaspoon of dry mustard
Dash of pepper
½ cup of vinegar (or lemon juice)
2 eggs

Mix the dry ingredients in the top of a double saucepan. Add the eggs and beat lightly and stir in the cream and then the vinegar a very little at a time. Stir the mixture over boiling water until it is thick like custard.

Use as required. If it is stored in a tightly covered jar, it will keep for several weeks.

Condensed Milk Dressing (No. 2)

Sweetened condensed milk
Seasoning
Lemon juice or vinegar

Stir the juice into the condensed milk until it is sufficiently tart. Add seasoning to taste. This dressing thickens up on standing and may be thinned as required with ordinary milk. It will keep several days but not after ordinary milk has been mixed with it.

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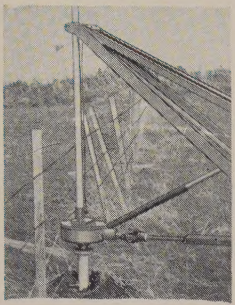
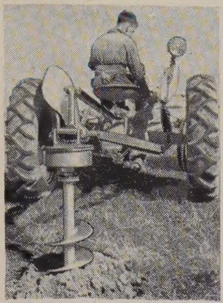
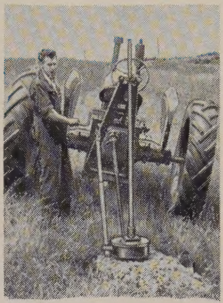
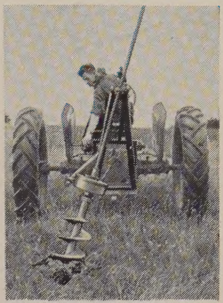
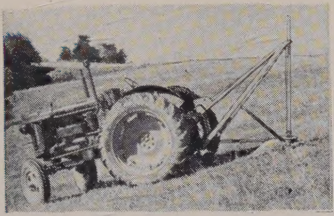

Type "U" boring a hole in an existing fence line without removing or slackening any wires. Type "H" will do the same.

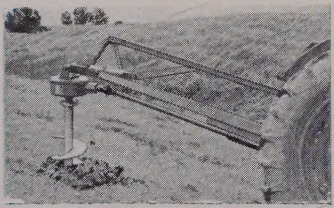

Type "H" on a Ferguson Tractor. Note that operator remains on the tractor seat and holds the hydraulic control lever.


Type "U" on a Massey-Harris Tractor. Note how the operator is controlling the boring with his hand on the winch.


Type "U" on a Massey-Harris Tractor putting down an angle-hole. Illustrating the flexibility of the "CHALLENGE".


Type "U" on a Fordson Major Tractor. Plumb holes automatically bored on hillsides as the "CHALLENGE" is self-plumbing.

Type "H" on a David Brown Tractor. The operator is engaging the P.T.O. to commence boring.


Type "H" on a double angle but plumb hole assured. The tractor position makes no difference to the operation of either type "U" or "H".

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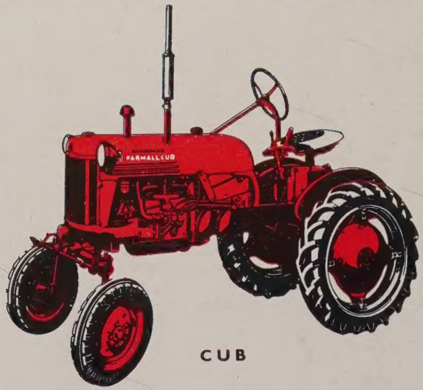

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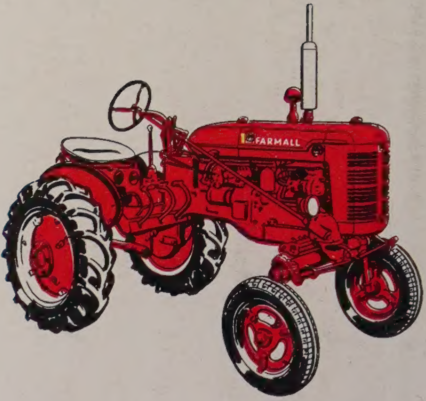

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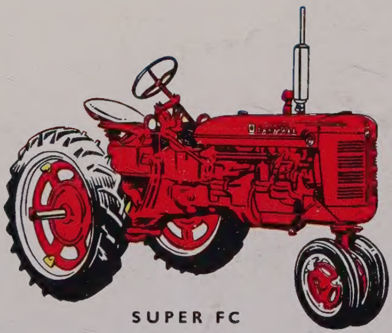

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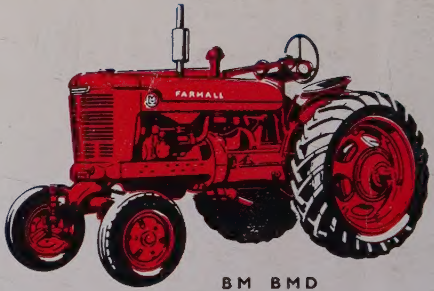

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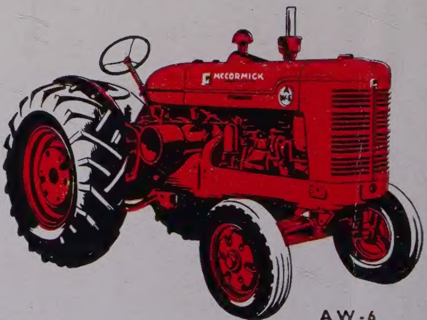

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